



Abstracts of MSc theses

Completed by ILRI Graduate Fellows
2006–2007

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International Livestock Research Institute

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Introduction

The International Livestock Research Institute (ILRI) is one of 15 future harvest centres, which conduct food and environmental research to help alleviate poverty and increase food security while protecting the natural resource base. Building on three decades of experience, ILRI works at the crossroads of livestock and poverty by bringing high quality science and capacity building to bear on poverty reduction and sustainable development. As part of its research-based outreach and capacity strengthening, ILRI assists its partners by offering opportunities for long- and short-term training for researchers and development practitioners. Capacity building is a core priority of ILRI because of the important role it plays in economic growth and development as well as addressing the rapid changes in the bio-physical, socio-cultural, technological and policy environments of the agricultural innovation systems in the developing as well as the developed world.

ILRI offers individual and group training courses. Both are aimed at largely building the capacity of the individual. Individual training is focused on harnessing the skills and abilities of individuals to contribute to the realization of developmental goals, which may include improved livestock management systems and enhanced research outputs and outcomes. ILRI has five categories of individual trainees: Attachment Associates, Student Associates, Technical Associates, Research Fellows and Graduate Fellows.

Graduate Fellows are mostly employees undertaking MSc and PhD studies. Postgraduate training is a priority activity of ILRI as it contributes significantly to the research agenda of ILRI and to the national and regional human resource pool in many regions of the world. This group of graduates will continue the research on emerging issues and will form the core of future collaborative research and innovation partners of ILRI.

ILRI supports a number of Graduate Fellows every year. The outputs of their work would end up as thesis and various publications. Not every researcher, however, has access to these materials. The result of the research efforts of the Graduate Fellows have limited impact due to lack of wider circulation of their findings. This publication of the abstracts of the thesis work supported

by ILRI as a compendium is one way to make sure that the results are widely distributed among the various research and development practitioners working within the livestock innovation system.

The purpose is to make the R&D community to be aware of the research work completed and the key findings. If you need additional information, please contact ILRI's InfoCentre directly where copies of these theses are deposited. We sincerely hope that this document will contribute positively in planning the future research activities and also will eliminate potential duplication of efforts.

P Anandajayasekeram
Manager, Capacity Strengthening Unit
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Analysis of red pepper marketing: The case of Alaba and Siltie in SNNPRS of Ethiopia

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Abstract: This research attempts to examine red pepper marketing in Alaba and Siltie with the specific objectives of identifying marketing channels, and the role and linkage of marketing agents; quantifying costs and margins for key marketing channels; identifying factors affecting volume of pepper supply in Alaba and Siltie and examining integration between regional markets and the terminal market. Red pepper marketing channels and the role and linkage of marketing agents have been evaluated using structure, conduct and performance approach. This study also attempts to investigate the performance of pepper marketing channel by analyzing marketing costs and margins, and examines the integration of pepper markets over the 2001/02–2004/05 period by using Cointegration and Error Correction Model. Moreover Tobit and Heckman two stage econometric models were used to investigate factors affecting pepper market participation decision and quantity supply of pepper. According to the results of the study, in 2004/05 regional wholesaler and urban assemblers purchased about 44 and 28% of farmers' production, respectively.

Sample markets were inefficient, characterized by oligopolistic market structure in Addis Ababa, Alaba and Tora markets. Research findings suggest that an improvement in producers' bargaining power through cooperatives is necessary to reduce the oligopolistic market structure. In Alaba Kulito market, traders set purchase price after mid night. Based on this price setting strategy, there is an urgent need for government intervention. Structure of the markets indicates that licensing and years of pepper trade experience did not hinder entry into pepper market, but education and capital were barriers. Market information is the main problem. Markets also are characterized by low producers' share and high marketing cost. Based on the Heckman two-stage model, the study has identified the main determinants of pepper market participation decision and its effect on the quantity supply. One of the most important variables influencing the decision to participate in pepper market is pepper production. Consequently, extension work should focus on

encouraging farmers to participate in pepper production. Especially, there is a need to increase new varieties that are disease resistant variety and disseminate these technologies to potential areas.

The other factor that adversely affects market participation is crop yield of the households. Keeping their specialization and social role in pepper production potential areas is necessary. Moreover, pepper production and extension contacts are the determinant factors of the quantity of pepper supplied. Therefore, policies that would improve pepper production capacity by identifying new technologies and create stable demand for surplus production would enhance farmers' decisions on marketable surplus. Non-farming income and the number of livestock affected the quantity of pepper supplied negatively. Thus, stakeholders have to make further investigations on cost and benefit of non-farm income and livestock production of farmers and let them know the result to make their decision. Further, the result shows that Siltie zone pair markets (Fora Silti, Tora-Alem Gebeya, Tora-Dalocha, Silti-Alem Gebeya, Silti-Dalocha and Alem Gebeya-Dalocha) are integrated. However, the terminal market (Addis Ababa) is not integrated with the regional markets (Alaba Kulito, Silti, Dalocha, Tora, and Alem Gebeya) even though the regional markets are the major pepper suppliers to Addis Ababa market. This implies that there is poor market information system, limited bargaining power of farmers, and oligopolistic market structure in the pepper market. The findings suggest that effective market information service has to be established to provide accurate and timely information to farmers and traders on current supply of pepper output, demand and prices at national and regional levels. Market structure of pepper market (strong oligopoly market) also influenced market integration, implying the need for creating competitive market structure.

Correlation of plasma lipid with susceptibility of inbred laboratory mice to experimental *Trypanosoma congolense* infection

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Abstract: Mammalian hosts of African trypanosomes show marked differences in susceptibility to infection with *Trypanosoma congolense* as judged by survival time, anaemia, and levels of parasitaemia. For instance, the N'Dama cattle and the West African shorthorn breeds are resistant to Trypanosomiasis whereas the Zebu and European cattle breeds are in general more susceptible. Similarly, C57BL/6J mice are relatively resistant to *Trypanosoma congolense* infection than BALB/c and A/J strains because bloodstream trypanosomes cannot synthesize lipids *de novo*, and that resistant animals (cattle, buffalo, and mice) have lower plasma lipid levels than the susceptible ones. It was hypothesized in this work that plasma lipids influence progression of Trypanosomiasis. Furthermore, genetic studies have mapped the quantitative trait loci (QTL) for trypanotolerance and plasma lipid levels in mice to the same region. Finally, studies indicate that the genes that control plasma lipid levels are differentially expressed in resistant versus susceptible strains during Trypanosomiasis. To investigate this hypothesis, the plasma lipid levels of C57BL/6J, A/J, and BALB/c inbred mice were manipulated by feeding them (*ad libitum*) on calorie matched low (5.16%) or high (23.45%) fat diets. The diets were designated low or high fat when compared to the basal (10% fat) laboratory mouse diet. Mice were then infected with *T. congolense*. Parasitaemia, body weight, plasma lipids and anaemia were then monitored. Results indicate that the mice on the high fat diet suffered more weight loss and had low parasitaemia than those on the low fat diet. Hence it can be concluded that high plasma lipid levels do not aggravate Trypanosomiasis.

Effects of economic and gender related factors on urban livestock production systems and health hazards predispose to producers in Ibadan and Kaduna

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Abstract: This study made a comparative analysis of the economic and gender related factors, which promote urban livestock production systems in Ibadan and Kaduna. The specific objectives to achieve this broad objective include identification and description of economic factors, which promote urban livestock production systems, assessment of the factors that predispose producers to health hazards, and making of recommendations towards the improvement of the performance of livestock farmers, so as to ensure a sustainable agricultural development. Data used for this analysis were collected through the use of questionnaire administered to 516 respondents in Ibadan and 517 respondents in Kaduna. The data obtained were analyzed in line with Harvard analytical framework using descriptive statistics, such as tables and percentages. The results showed that in Ibadan males have exclusive access and control over cattle while in Kaduna female have very little or limited access and control over cattle. In general, women in both cities were found to have more access and control over both local and exotic chicken. Women in Ibadan were found to have more access and control over goat. Ownership of assets and membership of social groups in the study area is poor contributing to the difficulties in the acquisition of credit (loan).

About 23.3% in Ibadan and 15% in Kaduna of the livestock producers share utensils with their livestock and a very small proportion of the producers 4.8% in Ibadan and 3.8% in Kaduna do not wash hands and body after tending to animals.

Finally it was also observed that at the two locations cattle and sheep enterprise has very higher gross margin during the peak season of sales. It is therefore recommended that producers sell during the peak season of sales.

Epidemiological studies on *Peste des petits ruminants* (PPR) disease in sheep and goats in Northern Jordan

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Abstract: *Peste des petits ruminants* (PPR) are an economically important disease affecting sheep and goat industry in Asia and Africa. In this study we investigated the seroprevalence of PPR in sheep and goat from 5 different governorates (Irbid, Jarash, Ajloun, Mafrq, and Zarka) in the northern part of Jordan. Serum samples from 929 and 400 sheep and goats, respectively, corresponding to 122 sheep flock and 60 goat herds were collected. Serum sample we subjected to a MAb PPR competitive ELISA. Health status and management information were collected in a semi-structured pre-tested questionnaire. The true prevalence of sheep and goats was 35 and 55%, respectively. The prevalence in sheep flocks and goats herds was 67 and 81%, respectively. Sheep and goats older than 4 months and younger than 2 years had the highest PPR seroprevalence. Larger flock size (OR = 2.2), visiting live animals market (OR = 3.3), migratory nature (OR = 1.0) and mixed farming (OR = 0.8) were found to be risk factors to sheep flock PPR seropositivity. Only larger herds (OR = 1.2) and visiting live animals market (OR = 2.6) were identified as risk factors for goat herds PPR seropositivity. Breed availability of veterinary services, and usage disinfectant had no impact on sheep and goat flocks/herds PPR seropositivity.

Comparative study of statistical association in data sets with reference to molecular marker data, phenotypic trait data and geographic data

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Abstract: In this research project, we review and evaluate statistical methods which are used to explore data structure and obtain association between multivariate data sets. The study reviews the research work on association studies in data sets with interest on the methods used. The methods are then categorized into those that are used to evaluate data structure and those used to evaluate associations in the data sets. We also review the methods commonly used for evaluation of data structure and propose other methods which will add more insight into association in the data sets. Besides the existing and commonly used methods such as principal component analysis (PCA), principal coordinate analysis (PCO), Mantel test and cluster analysis, we propose the use of procrustes analysis procedure, minimum spanning network method and constrained analysis of the principal coordinates as additional methods which can be used to evaluate association of multivariate data sets. We look at how different data types namely; molecular marker data, phenotypic trait data and geographic data are generated which are then analyzed to evaluate data structure and to investigate association between the data sets by using the methods reviewed.

Fine mapping of trypanosomosis resistance loci in murine by Haplotype approach

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Abstract: Mapping of trypanotolerance QTL in two F2 resource populations generated by crossing BALB/c and A/J with C57BL/6J has previously been achieved by Kemp et al. (1997). The subsequent fine mapping using the advanced intercross line (AIL) found the same to be true in F6 using same strains of mice (Iraqi et al. 2000). To confirm and fine map the QTL, a genome-wide scan for quantitative trait loci (QTL5) affecting trypanotolerance in a population of 300 F2 progeny derived from a cross between 129/J and, C57BL/6J. Two trypanotolerance QTLs (*Tin* and *Tir3*) were detected at the genome-wide 5% or less level. *Tin* and *Tir3*, located on Chromosomes (Chrs) 17 and 1, respectively, had main effects on trypanotolerance. However, *Tir2* on Chr 5 was not detected at the same level and had LOD score below 2. Resistant (tolerant) alleles derived from C57BL/6J were responsible for the high trypanotolerance effect. These results indicated that the genetic control of trypanotolerance is complex and the identified QTL5 may provide new insights into the pathogenesis of trypanotolerance in mice as well as in livestock and humans.

Genetic characterization of African chicken using Mitochondrial DNA D-Loop sequences

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Abstract: Knowledge of the genetic diversity is a prerequisite for better utilization of any genetic resource. However, such information is lacking for the indigenous African chicken. Mitochondrial DNA (mtDNA) displacement (D)-loop sequences were used to study the genetic diversity, genetic differentiation and phylogenetic relationships between domestic chicken populations and/or breeds of Africa. A total of 398 individuals belonging to 28 populations were sampled from 12 African countries. The hypervariable 1 (HV1) segment of the D-loop was PCR amplified and subsequently sequenced. The sequences of the first 397 nucleotides were used for analysis. Fifty-two haplotypes were identified from 50 polymorphic sites with polymorphism between nucleotides 167 and 397 contributing to 96% of the sequence variations. Phylogenetic analysis of the haplotypes indicates that African domestic chicken mtDNA can be grouped into six distinct maternal lineages with one to four lineages observed in each population. One of the haplotypes (represented by Bur60) is shared by all populations except Malawi, suggesting that these populations may share the same maternal ancestor. The phylogenetic relationships between populations show a close relationship between Kenya, Malawi, and three Botswana populations (Malolwane, Semitwe and Motokwe). Genetic variations within populations and between populations accounts for 64.8 and 35.2% of the total genetic variation, respectively. Network analysis shows a star-like population structure which suggests a rapid population expansion from a small number of founding ancestors. These results show a high mitochondrial D-loop diversity in African chicken and indicate multiple maternal origins for African domestic chicken.

Genetic diversity and relationship of indigenous goats of sub-Saharan Africa using microsatellite DNA markers

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Abstract: This study was undertaken to determine the genetic structure, relationship and genetic diversity among 18 populations of goats from sub-Saharan Africa including Uganda (4), Tanzania (5), Kenya (2), Mozambique (2), Nigeria (3), Mali (1) and Guinea Bissau (1) using 11 microsatellite markers. Heterozygosities, estimates of gene differentiation (F_{ST}), genetic distances, multivariate and diversity analyses were performed. Expected heterozygosity ranged from 0.450 in Guinea Bissau to 0.541 in Mbeya, while the observed heterozygosity ranged from 0.441 in Pafuri to 0.560 in the Sebei. Total genetic variability of 5.3% was attributed to differences among populations while 94.7% was attributed to differences within populations. The genetic diversity was low with a mean number of alleles (MNA) per population ranging from 3.82 to 5.91. The analysis of molecular variance (AMOVA) indicated that a greater proportion of the genetic diversity in the sub-Saharan goat populations is within the populations. The genetic distances between sub-Saharan goat populations were generally low. The classification of the sub-Saharan goat populations based on the morphological features (phenotypic characterization) does not concur with the genetic classification revealed in this study.

However, the results confirm earlier studies that the genetic relationships of these populations are much linked to geographical location than the classification based on the shape of the horns and ears. It appears likely that the sub-Saharan goats have a common origin and that there is extensive gene flow between populations.

Genetic and non-genetic analysis of fertility traits in Holeta and Ada's Berga dairy herds

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Abstract: This study was conducted to estimate non-genetic and genetic parameters and breeding values and assess genetic and environmental trends of reproductive traits for both Holstein and Jersey herds at Holetta and Ada'a Berga dairy farms in central Ethiopia. The study was set up to test three hypotheses: (1) Selection based on phenotypic traits doesn't bring about genetic progress in the herd. (2) There exists unfavourable genetic correlation between fertility and age at first calving. (3) There is unfavourable genetic correlation between 305-days milk yield and fertility traits. Data from Holetta and Ada'a Berga dairy farms were used for this study. For the analysis of fixed effects, a total of 7501 records were used. For genetic parameter estimation, a total of 4874 records for Holstein, 3996 records for Jersey and 6918 records for the two of the breeds together were used. The implications of non-genetic and genetic effect on reproductive performance were discussed in relation to the effect of season, year, breed, 305-days milk yield group and parity. Results of the analysis on non-genetic factors on overall performance suggest inconsistency in management and variation in climatic conditions. Overall reproductive performance levels were inadequate. So from the analysis, the established fact of large-sized cows are less fertile than smaller cows are not accepted here for these two herds because of unfavourable environment to loss or non-fertilize their embryo lately (increase DO and CI) or there may be effect of using small number of sire for long period of time in the herd (please look this part again). The results showed that calving year and breed have significant effect on fertility and production traits and there were fertility problems for Jersey breed because of non-genetic factors. 305-days-milk yield and fertility traits had negative phenotypic correlation for both Holstein and Jersey breeds. This antagonism for the two traits implies that when 305-days milk yield decreases fertility increase and vice versa. Heritability value and additive variance of all traits for Holstein breed was at least two times higher than Jersey breed, in which the result suggested that the values of additive genetic variance are important for the evaluation of productive and reproductive traits in these

two herds. Genetic correlation of age at first calving and 305-days milk yield was low and negative for both breeds. Genetic correlation of 305-days milk yield and fertility traits was from low to moderate but positive for both breeds. This reflects the antagonism of the production and reproductive traits. AFC and fertility traits had moderate to high negative correlation for Jersey breed and weak and positive correlation for Holstein breed. This negative correlation of Jersey breed for AFC may be because of utilization small number of sires having lowest AFC for long period of time. As observed in the relationship of breeding value of AFC and other fertility traits (DO, CI, PFB, SP) from the same sire, there was an antagonism that when AFC become lower (favourable for itself) for sire 18 of Jersey breed, breeding value of all fertility traits become lower (unfavourable) and above the mean; similarly when AFC become higher (unfavourable) or near to the mean as observed in sire B-41 of Jersey breed, fertility traits exhibit lower breeding value. This lower value of AFC or early breeding of animal had negative consequence such as calving difficulties, negative energy value (availability of feed for growth) for recovery of uterus. When AFC become higher it was the consequence of poor growth due to different factors. This in turn affects efficiency of calving and conception. So to improve performance of fertility traits, breeding value of AFC should be optimum. Phenotypic trend of fertility traits was negative while genetic trend shows a positive trend reflecting that management and environment (insemination time, inseminators' efficiency health and others) was the main target to improve fertility traits. The genetic trends of 305-days milk yield also shows a declining trend in both breeds. Environmental trend shows a favour for Jersey breed than Holstein breed because of low genetic variation in the Jersey breed. So this study suggests that there should be an increment in genetic variation in Jersey herds by importing semen from different sire line. For Holstein herd, even though there was negative genetic trend of 305-days milk yield for the years 1995 to 2000, emphasis should be given to environment and management as the farm given at this time. This farm was handled by milk enterprise before 2001 but after 2001 the farm shift to MOA (AI) and together with this there was a lot of change like feeding lactating cows based on their production, age wise feeding of calves, separate housing of calves, isolation and treatment of TB positive and negative. As observed in the phenotypic trend, AFC and 305-days milk yield shows an increment from 2000 onwards. This is because of, as mentioned above, improvement of management and

introduction of Israel breed from 1995 to 2000. But further efforts need to be made in controlling the production environment to avoid slowing the rate of genetic gain in milk production due to an antagonistic relationship with fertility trait.

Impact assessment of rain water harvesting technologies: The case of Atsibi Womberta Woreda, Tigray Region

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Abstract: To mitigate the erratic nature of rainfall in the arid and semi-arid parts of the country, which threatens the lives of million of people, a national food security strategy based on the development and implementation of rain water harvesting technologies either at village or household level has been promoted for improving productivity and sustainable intensification of the rain fed agriculture. This study examines the socioeconomic and biophysical factors affecting a farm household's RWH technology adoption decision in Tigray, Atsibi Womberta *woreda*, northern Ethiopia; and the impact of the rainwater harvesting technologies on crop yield. This study develops a theoretical framework to test hypotheses and to investigate the determinants of household's RWH technology adoption decision, the determinants of yield differences across plots, and the impact of rain water harvesting ponds on crop production.

The factors are analyzed using plot-level data surveyed from 100 households, (52 households with RWH technology and 48 households without RWH technology). In this study, the econometric analysis adopts OLS and probit models based on the nature of the dependent variables under investigation. Besides, to augment the results of the econometrics analyses descriptive, crop-mix, and qualitative analyses have been adopted.

The results of the crop-mix analysis showed that a comparison of the 'with' and 'without' situation with respect to the crop type grown, based on the crop category, shows a major shift on farm household's crop choice decision from cereals and pulses towards perishable and perennial cash crops, including vegetables, spices, and fruits, and/or an intensification in agricultural production. The findings of the econometric analysis of the probit model shows credit access, plot size, plot proximity to residence, purposes of the plot, and savings as the major positive determinants factors of household's RWH

technology adoption decision. Consistent with this, the results of the analysis of qualitative information witnessed lack of capital, lack of plot or small plot size, and problems related with structure or design of the RWH technology adopted as the main problems facing households, and have a negative impact on the technology adoption rate.

Finally, the results of the OLS estimation showed that, although the impact of most of the household-level factors was indirect through the factors inputs, except for seed, the impact of the other factor inputs is insignificant. However, household head involvements in non-farm labour, education level, greater ownership of oxen, and plot fertility have significant positive impact, while credit access, ownership of greater pack animals and small ruminants, and rented plots have witnessed negative impact on value of crop yield. Besides, the study has found no significant effect of RWH technology on value of crop yield. However, other interesting result implied from this study is that, though initially the RWH technology was introduced as a supplementary source of water for cereal and pulse crop production during dry spell periods, the majority of the farm households have used the accumulated water for horticulture production. The agricultural intensification would in turn have positive potential to increase the income of farm households.

Impact assessment of rain water harvesting ponds: The case of Alaba Woreda, Ethiopia

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Abstract: This study assesses the determinants of households' adoption of rainwater harvesting ponds, and its impact on agricultural intensification and yield in Alaba Woreda, southern Ethiopia. Results are based on data collected from a survey of 152 households and 1036 plots operated by the households. Households were stratified into those with rain water harvesting ponds and those without from which equal number of sample households were drawn. Analysis of descriptive information and econometric methods are used. Analysis of qualitative information supplemented the econometric results. The finding in the cropping pattern shows that farm households have started to grow new crops (vegetables and perennial crops) as a result of water availability from the water harvesting ponds. Results of Probit analysis on the determinants of adoption of rainwater harvesting ponds shows that household size, education status of household head, ownership of livestock (cattle, oxen and pack animals), homestead plots and type of pond explained adoption statistically significantly. Results of analysis of qualitative information, consistent with the Probit model results, also showed that labour requirement, economic problem to use simpler water lifting and watering equipments, inability to easily understand the benefit of the technology and problems related with the structure of the RWH technology adopted were some of the major problems faced by households, and thus have a negative impact on the technology adoption rate.

The Ordinary Least Square estimation of the determinants of the value of crop production shows that adoption of RWH has a positive and statistically significant effect on value of crop production, after controlling for input use and other factors. This shows that RWH ponds have direct and significant impact on value of crop production. We also find that households with RWH technology use more labour and seed but less oxen power compared with those households who have not adopted the technology. Moreover, labour and seed inputs have positively significant impact on yield while the effect of oxen power is insignificant. These results show that in addition to its direct impact,

RWH has significant indirect impact on value of crop production through its effect on intensity of input use.

Labour requirements and cost considerations appear to be important factors that influence household's adoption of RWH technology. This implies that research and development interventions need to take account of the labour and cost demands of the technology. The effectiveness of the technology adoption is mainly constrained by problems related to water lifting and watering equipments, and accidents occurring due to absence of roof cover and fence to the ponds. This implies that support will be needed to provide affordable but improved water lifting and watering equipments, and give training to farm households on construction and use of roof covers and fences to the ponds. As households shift to high value but perishable commodities due to the RWH, emphasis needs to be given to marketing extension, especially in facilitating markets and market linkages to farmers.

Future intervention to promote RWH technologies need to provide due attention to quality, rather than focusing on the number of adopters. Households appear to neglect the community ponds since they focus on using cleaner water obtained from household ponds and other sources of clean water. In this process the community ponds are becoming a cause of health problems. Thus, it is important that appropriate attention be given to the community ponds as well.

Impacts of *Prosopis juliflora* invasion and control using charcoal production in Afar National Regional State, Ethiopia

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Abstract: A survey on impacts of *Prosopis juliflora* invasion on people's livelihoods and ecology and the contribution of promoting charcoal production for its control was carried out in Amibara and Gewane *Woredas* of Afar National Regional State, Ethiopia. The survey was conducted in areas where charcoal production was promoted and in non-intervention areas including the different occupation groups in the area to compare the variations.

The survey showed that, although local people are increasingly using *Prosopis* products due to lack of choice and realized some contributions of the tree to the environment, the losses from the invasion outweigh the benefits and they prefer eradication. There is no major difference on product use in intervention and non-intervention areas except for charcoal. External charcoal makers and a few local people use *Prosopis* for income generation purposes, primarily for charcoal. Charcoal production and marketing was a profitable business both to producers and traders involved in the enterprise. The contribution of charcoal production to minimizing *Prosopis* invasion was found to be variable depending on the potential of the land and land use practice. In areas which had access for irrigation water and were cultivated following the removal of the thicket, the invasion was reduced. In communal rangelands and non-cultivated areas, the invasion becomes worse as the tree sprouts from stumps left by the charcoal producers. In some pasturelands, where the stumps were removed, community members who use the pasture were not prepared to uproot the emerging seedlings and use the land for pasture and it was re-invaded. The extension and regulatory support from the government side was weak and focus of individuals and the cooperatives involved in charcoal production and marketing was on income and little attention was given to the control of the invasion. Recently, the operation has become uncontrolled and

has been banned by the government. It requires preparation of realistic land use plan for invaded areas taking account of the potential of lands.

Moreover, the regulatory and extension services and traditional resource management systems should be strengthened; policies and strategies could be issued to promote utilization of the resource targeted for control of the invasion from potential areas.

Review of the delivery of veterinary services with reference to small ruminants and animal access to market

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Abstract: The study emphasizes the role of animal health delivery system and the ability of planners to create a good environment for privatization and community-based animal health workers system, as one of the needs of the International Livestock Research Institute (ILRI) and International Center for Agricultural Research in Dry Areas (ICARDA) to improve sustainability of animal care, and other activities related to husbandry in the Sudan. The study areas for this study were Gadarif State, Blue Nile and before West Kordofan now North Kordofan (Elkhowie area) to identify entry points along the market chain (veterinary infrastructure facilities in the project sites, villages, household/flocks, markets, traders, slaughterhouse, and quarantines).

The selected areas practice more on the other of the traditional systems of management, mainly, sedentary, transhumant (seasonal movement) and nomadism. Delivery of veterinary services under these production systems poses a challenge to veterinary authorities and policy makers. The project has also relationship with Near East and North Africa (NENA) to update information on breeding, feeding, management, livestock production, and marketability of small ruminants. The accessibility to the market should depend on the delivery services which will be of value and help to those concerned of animal. Livestock breeding must, of necessity, be to control diseases. However, the basic fact has been, if not poor, ignored and complete failure occurred in some remote areas. Moreover, there are other constraints which limit animal rearing such as continuous movement to search for water and pasture, environmental changes, geographical and ecological differences in the country.

The pastoralists traditional knowledge, acquired by observations of different animal problems, are not enough to combat several diseases by using only antibiotics. Hence, further intervention is needed for management

and husbandry, which is supposed to be carried out by communities, field veterinarians, and para-veterinary professionals in the field.

The role of community-based animal health workers (CBAHWs) in West, South and East Africa is well established because of recognition and regulation enforced by veterinary authorities and policy makers. However, in the Sudan, the law to regulate community-based animal health workers is still in the drawers. According to the respondents, the *peste de petits ruminants* (PPR) was prevalent during the last three years (2005, 2004 and 2003) as followed (31.1, 26.0 and 12.7%), respectively. Sheep pox was (16.1, 26 and 44%) respectively and finally heart water was (14, 7.9 and 8.2%) respectively. Visits of veterinarians and administrative units staff are differed from state to another. Blue Nile State covered over 85%, and for the other sites less than 20% annually. Most of the households manage their animals alone, except in Gadarif where some hire a shepherd for management and husbandry paying them in cash or in kind of offspring.

The means of transport to the local or terminal markets is mostly by trucks or on walking. However, the role of railways has declined. In the three sites of the study, the traveling to the veterinary clinics or diagnostic laboratory which distance range between 50–150 kilos is covered by means of transport (lorries, equines), where it takes (3–4 hour), and the cost of journey (SD 200–500). Concerning treatment, the government has authority to carry out delivery services as well as monopoly of vaccinating livestock. The provision of services according to states in Blue Nile, West Kordofan, and Gadarif were (62, 42 and 12%), respectively

Privatization was established since 1980s and is still in need of implementation and intervention to recognize the role of (CBAHWs) to achieve the services and as compensatory agents to fill the gaps in remote areas. The study found there is inadequacy of equipment, destruction of infrastructure, poor capacity building and lack of extension which is considered as the backbone to raise awareness and development of veterinary service in the three states and Sudan in general.

In the study areas, the ratio of vets per livestock unit is higher approximately (1:150,000–200,000) in comparison to what has been recommended by

international organizations (FAO/WHO) for the developing countries, which is 1:30,000. Hence, the study recommended employment of more vets and encouraged the private sector to invest in the veterinary delivery services.

Sero-prevalence and impact of selected diseases (*peste des petits ruminants* (PPR) and heart water) affecting small ruminants in Western Krodofan (Elkhowei), Blue Nile and Gadarif States of the Sudan

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Abstract: The aim of this research is to study the epidemiology of the most important small ruminants' diseases in order to make a rational decision for their prevention and/or control. The ultimate aim is to improve the livelihoods of poor small ruminants keepers in the Sudan through research targeted at the selected small ruminants' diseases resulting in increase productivity and enhanced access to markets. Therefore, research objective will focus on:

1. Determination of prevalence and economic impacts of diseases of small ruminants, with a focus on *peste des petits ruminants* (PPR), and heart water.
2. Identification of possible feasible interventions to reduce or minimize their negative impacts on the livelihoods of small ruminants' keepers.

Studies on cattle milk and meat production in Fogera Woreda: production systems, constraints and opportunities for development

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Abstract: The study was conducted in Fogera which is one of the districts found in the northern part of Amhara Region with the aim of characterization of cattle milk and meat production systems of the *woreda*, to provide the basis for cattle development interventions. Even though the known indigenous Fogera breed is also found in this *woreda*, little attention has been given to characterize the milk and meat production system, to assess the production inputs, to identify the dairy products and beef market chain participants and to identify the main constraints and outline the interventions. It is with this in mind that the present study was initiated.

Twelve sample peasant associations were randomly selected (Five from Fogera plain and seven outside the plain) based on the potentiality of milk and meat production. Exactly 480 respondents participated in the study. Different survey techniques; namely focus group discussion, data collection by developing formats, personnel observations and administration of semi-structured questionnaires on milk and meat production practices were employed.

The findings of the group discussion revealed that the types of cattle husbandry practices of the respective study sites (PAs) were different between rural and urban areas. The findings from the semi-structured interviews revealed that 98.75% of cattle milk and meat productions were undertaken by indigenous cattle breeds. The type of husbandry practice was traditional. Further more, the respondents were very much interested to improve their local breeds by artificial insemination and natural mating by crossbred bulls to upgrade the milk productivity of the breeds. The number of cattle per household was significantly different among the village ($P < 0.0001$). Moreover, the average number milking cows per household ranges from 1.18 to 1.08. The holding of milking cows per household was 1.59 ± 0.04 where holding of private pastureland was 0.18 ± 0.09 , thus the lower production milk per household

may be due to insufficient pastureland and feed scarcity. Milk produced per household was highly correlated ($P < 0.01$) with the number of cows owned by the household and less correlated ($P < 0.05$) with area of pasture owned by the household. The average lactation length for local breeds was 7.5 months and the average daily milk yield was 1.5 liters. Age at first calving is 3–5 years perhaps due to malnutrition. The reported critical constraints of traditional cattle production were seasonal feed shortage, high disease prevalence challenges, lack of cross breeds and working capital and lower demand for dairy and beef products due to long fasting periods and lower purchasing power of the consumers.

A study on the response of three genotypes of *Mucuna pruriens* to different growth media for tissue culture differentiation

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Abstract: *In vitro* regeneration using meristem explants to induce shoots and roots in *Mucuna pruriens* genotypes were investigated. Different treatment combinations of culture media containing growth hormones, nutrients and vitamins were evaluated to promote shoots and roots directly from the meristem explants and indirectly via callus phase. A total of 13 experiments were conducted. Among the various cytokinins, BAP, Kn, 2ip, GA3 and TDZ tested, the survival of tissue (shoots and callus) was found to be effective in BAP combined with an auxin NAA. The cytokinins, BAP and TDZ induced multiple shoots. An optional level of 0.1mg/1 BAP supplemented with liquid media containing ¼ G-B5+7.5g/1 sucrose supplemented with 5mg/1 IBA was effective in root induction. BAP along with an auxin ANN was effective for survival of tissues (shoots as well as callus). Rooting was induced at the base of the shoots proliferated on media containing lower concentrations of BAP. However, shoots proliferated in TDZ containing media difficult to root. No organogenesis was observed from callus regardless of the different media evaluated. Among the accessions, 10084, 14880 and 15169 accession 14880 performed relatively better in tissue survival percentage as well as percent of shoot survival. Results from callus and shoots were often different and should not be compared.

Survey and rectification of the causes of poor fertility and hatchability of eggs from Rhode Island Red (RIR) chicken breeds in Ethiopia

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Abstract: This study comprises two parts: Survey and on-station experiment. The objectives of the study were to identify some possible causes of poor fertility and hatchability of eggs from Rhode Island Red (RIR) breed and to control the water loss of fertile eggs by spraying vegetable oil and elevating the relative humidity (RH) during incubation period to improve the hatchability in RIR eggs. The field study was carried out in the selected four regional zones (Sidama, western Gojam, eastern Hararghe and eastern Showa). The sampling techniques used were non-probability sampling comprising both purposive sampling (Zones and *Woredas*) and convenience sampling (villages and farmers). The hatching eggs for the experiment were collected from Kombolcha Poultry Breeding and Multiplication Centre and were conducted at Debrezeit Agricultural Research Centre (DZARC). The five treatments used for the experiment were: 1) maintaining 80–85% RH for the whole incubation period on 298 eggs 2) treatment 1 + spraying vegetable oil on 298 eggs 3) maintaining 90% RH for the whole incubation period on 291 eggs 4) maintaining 5% more RH the treatment 1 (90% RH) after 12th days of incubation till the remaining period on 292 eggs and 5) maintaining 5% more RH than treatment 1 (90% RH) during the hatching period only on 294 eggs. Statistical package for social science for field (survey) data and statistical analysis system for the data obtained from on-station experiment were employed. The current survey result revealed that breed, environment, and some management factors by the farmers affected the hatchability of eggs from local and RIR breeds. There was a highly significant hatchability difference ($P < 0.001$) between breeds (local and RIR). The different management practices like egg storage duration, egg storage condition, egg storage position, prepare and test of eggs before incubation, treatment of broody hens, setting and bedding materials, treatment of hatching eggs before incubation, size of the eggs, sex ratio, disease and nutrition both supplementation and concentrate provision and environmental factors like season were observed to affect the hatchability and also helped to

have the observed significant hatchability difference ($P=0.00 - 0.02$) among zones. Even though identical information were collected from the selected PBMC (Awassa, Andassa, Adele, and Adama), the laboratory result for the representative feed sample taken from Awassa PBMC indicated that some trace minerals (Cu, Fe, Mn, and Zn) were below the recommended level and affected the hatchability of eggs from RIR breed.

The experimental result from DZARC revealed that there was significant hatchability difference ($P<0.05$) within treatments on total number hatched chicks, percent fertility, percent hatchability both on total set eggs and fertile eggs and from multiple comparison between treatments. It can also be seen that the mean percent fertility for oil treated eggs were significantly different from the other treatment groups. Increasing 5% more RH (90%) than the recommended (80–85% RH) during hatching period helped to have a slight increase in the mean hatchability percent both on fertile and total set eggs than treatment 1 but there was a significant mean hatchability difference ($P<0.05$) both on fertile and total set eggs, and on the percent mean total number of hatched chicks due to increasing the RH by 5% more than treatment 1 during hatching period only than the other treatments. The low mean percent fertility, the low mean percent hatchability both on fertile and total set eggs, the low mean percent total number of hatched chicks related with the percent (4%) weight loss was observed for the oil treated eggs than the others. Finally the breakout analysis result indicated that death at later stage accounts first than death at earlier or medium stage.

Sustainability of small ruminants' production systems: A marketing-health approach

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Abstract: Small ruminants provide the support, treasury and insurance against risk in the areas with difficult climate and in particular in the rural zones. In Tunisia, they play an important role in the wellbeing of rural and in particular the small stockbreeders. Indeed the sheep and goats exceed the 4852 productive female units into 2005 are had by more than 290000 stockbreeders of which 80% are small farmers. The latter are characterized by a weak inheritance and a limited capacity of investment (Economic Budget 2005). They face several difficulties in particular: low productivity due primarily to problems of health, control and food of livestock, the difficulty of access to the veterinary services and to the market.

The objective is to determine the general terms of delivery of the veterinary services and evaluation of the effects of animal health on the participation of the small stockbreeders in the market and consequently on the improvement of the incomes of the latter and on the durability of the productions' systems of the small ruminants. With this intention, we tried to identify the factors which influence the market participation of the small stockbreeders and in particular the effect of animal health on access to the market.

These stockbreeders are generally poor and take part little in the market. In this study an approach of transactions costs was used to evaluate the conditions of access to the market and more generally the market efficiency. Indeed, the sustainability of the production systems is affected by the participation in the market and the condition of delivery of the veterinary services.

Key words: small ruminants, small stockbreeders, systems of production, market, animal health, sustainability.

Adoption of small ruminants' fattening package in agro-pastoral areas, Meiso Wereda, eastern Oromia

Zelalem Tamrat

Abstract: Many studies were conducted to identify determinants of adoption of crop-based technologies and practices and improved seeds while few studies focused on evaluation of extension services in terms of the clients' need and interest or adoption of livestock technologies in agropastoral and pastoral context. In fact, livestock extension services in general in developing countries are less prioritized and thus livestock-based technology services are rarely extended. Common livestock technologies which are promoted to livestock raisers are focused on feed, veterinary services, and improved management practices through the extension services of agricultural/pastoral offices and livestock development units. The case hereunder is about agropastoralists' extension services evaluative perception and small ruminant fattening package adoption. Hence, this study investigates agropastoralists' perception of the extension services, small ruminant fattening package and intensity of adoption and small ruminants' fattening package. The study is undertaken in Meiso Wereda, Oromia Region, Ethiopia. The *wereda* has agropastoral and pastoral production system. The data are collected from 151 randomly selected pastoralists and agropastoralists using structured interview schedule. Secondary data were collected from different sources to supplement the data obtained from the survey. In addition to quantitative data, qualitative data were also gathered. Prior to formal survey, an informal survey was also undertaken by using group discussion and interview with key informants. Descriptive statistics such as frequency, percentage mean, standard deviation, Chi-square tests and t-test were employed. The Tobit model was also employed to determine factors influencing intensity of small ruminant fattening package adoption. This study identifies agropastoralists while pastoralists are poorly addressed and their needs and interests are not considered in any extension programs. The Tobit model output showed that agropastoralists' intensity of adoption of small ruminant fattening package is influenced by: perception of the availability of improved breed, perception of resources-based conflicts, current management practices, total livestock holding of HHs and credit use and availability for veterinary purposes. Future extension activities and agencies

promoting fattening package in agropastoral and pastoral areas should focus on targeting agropastoralists with low perception of the availability of better breed, information and demonstration on the improved management practices, revision of credit supply criteria, awareness and demonstration of the significant importance of small ruminants in the agropastoral and pastoral income and livelihoods.

Agricultural information networks of farm women and role of agricultural extension: The case of Dale Wereda, Southern Nations, Nationalities & Peoples' Region

Deribe Kaske Kacharo

Abstract: Ethiopian rural women make significant contributions to agriculture and are the mainstay of the farm labour. They work in all aspects of agriculture. In addition to their active engagement in agriculture, women are responsible for all household chores. Despite their immense contribution to agriculture, rural women often face more difficulties than men in gaining access to agricultural information. The Ethiopian agricultural extension system suffers from a number of weaknesses in its services for rural women. There is, therefore, an alarming need to improve agricultural extension work with the rural women. Therefore, this study is intended to analyze the agricultural information network of farm women; to identify factors influencing farm women's information network output and to identify the constraints and opportunities of extension services in reaching out to women in Dale Woreda, Sidama Zone, SNNPR.

Three stages of sampling were used in which both non-random sampling and random sampling procedures was followed to select four Peasant Associations and 160 respondents. A structured interview schedule was used for collecting the essential quantitative data from the sampled respondents. To generate qualitative data, field observations, informal interview with key informants, and discussion with separate focus groups of women and men farmers were conducted.

The quantitative data were analyzed using descriptive statistical tools and also .2 = test, Cramer's V, Pearson's Correlation coefficient & Multiple Linear Regressions. The result of the study shows that neighbours or friends are the major and the most important source of information for the farm women. The major output of the study indicates that knowledge of dairy farming practice of women farmers was significantly influenced by communication

skill, interpersonal trust, social participation, total annual income, extension participation, empathy of respondents and access to credit.

The major constraints identified in agricultural information network of farm women were low participation of women in extension programs; poor access to credit; absence of market information and alternative market for products; extension methods contribute less as source of information. Therefore, it is recommended that the extension system operating in the area need to be strengthened further to increase the flow of information to women for rural transformation.

Analysis of demand for beef with a focus on quality and safety in Addis Ababa City, Ethiopia

Samuel Amare

Abstract: Conjoint analysis was applied to assess the part worth of beef quality and safety attributes using a cross sectional data from stratified sample of 300 households in Addis Ababa City collected in June 2007. The software used for estimation is SPSS 15. The results showed that fat content, freshness, neatness of meat shop and personnel, abattoir stamp and price are significant quality and safety attributes that consumers use in their beef purchase decisions. Interactive variables like family size, religion, age, schooling, stay in Addis Ababa and marital status are also found to significantly influence quality and safety perceptions.

On the other hand, some variables such as sex of meal planners are found to have insignificant role in quality and safety perception. The result further indicated that income has a great role in influencing people's perception regarding safety and quality of beef. The result could be used for designing safety and quality standard for local wet market.

Application of linear mixed models in microarray, University of Nairobi, Kenya

Mwero, Daniel Kimuyu

Abstract: This project captures the problem of large microarray datasets and seeks to identify a statistical model of microarray hybridization intensity data as well as describes differential regulations, sample variability and measurement noise. It also shows how one can use the data model to analyse the microarray data and develop optimal methods for detecting differentially regulated peripheral blood mRNA from cattle infected with *Trypanosoma congolense* using microarray in order to assay components of the immune and inflammatory responses and identify potential correlates of pathology. We conclude by giving an insight into linear mixed effects models by analyzing a data set from a cattle experiment that seeks to compare 'genome-wide' transcriptional responses in blood leukocytes following infection with species of *Trypanosoma* that differ in the severity of pathogen city.

Assessment of diversity, morphological variation and description of grasspea (*Lathyrus sativus*) and other related species

Martha Tsegaye

Abstract: *Lathyrus sativus* (grasspea) has been widely cultivated in South Asia and Ethiopia for over 2500 years and is used as a food and feed. It is rich in protein content, around 30 g/100 g edible seeds. Agronomically, the species is able to withstand both severe drought as well as water logging. Although seeds of grasspea are tasty and protein rich, excessive consumption of the seeds causes a motor neuron disease called neurolathyrism which is characterized by the paralysis of the lower limbs. The neurotoxic causal agent of this disease is believed to be a non-protein aminoacid called Oxalyl Di aminopropionic Acid (ODAP).

Morphological marker analysis and molecular analysis have been used widely to estimate genetic variability of populations. These methods are useful in addressing questions on population genetic structure and genetic conservation. Knowledge of genetic diversity of species is particularly important, since modern breeding practices have narrowed the genetic diversity of cultivated crops. In the case of grasspea, the problem of Lathyrism is leading to the banning of its production which in turn aggravates genetic erosion and loss of diversity of the crop.

Fifty one grasspea accessions which were selected from the genebank collection of the International Livestock Research Institute (ILRI) were evaluated and characterized for different qualitative and quantitative morphological characters. Cluster analysis was performed to estimate differences between accessions. Randomly Amplified Polymorphic DNA (RAPD) was also used to study the nature of variation. In addition to *L sativus*, three other species of the genus (*L cicera*, *L clymenum* and *L ochrus*) and seventeen unidentified populations of *Lathyrus* were also evaluated for morphological and biochemical characters and characterized accordingly.

Cluster analysis of both the morphological and the RAPD data showed that all of the unidentified *Lathyrus* populations were found to be *L sativus*. The result also showed that two of the accessions (5295 and 5296) represented by *L oehrus* and one accession (5282) represented by *L cieem* were found to be *L sativus*. The results would suggest that germplasm evaluation is important for proper characterization of populations.

Characterization of cattle genetic resources in their production system context in Danno District of West Showa, Oromia, Ethiopia

Jiregna Dessalegn Gurmu

Abstract: The study was conducted with the objectives of identifying relevant cattle categories and their functions in the production system, community-preferred important cattle traits at herd level for the different cattle categories and the desired expressions for all relevant traits. In addition, it assessed in participatory ways trait expressions at population level, and characterized livestock populations based on the actual expressions of relevant traits. Finally, the study identified those management practices that influence the expression of relevant traits. The study was conducted in three PAs of Danno district namely Danno Shanan, Gidda Abbu and Sayyo Gamballa.

A total of 90 households (30 households from each PA) were randomly selected for interviews. Twenty key farmers from each PA were purposively selected to collect data on cattle management and farmers' way of assessing important trait expressions. Open-ended structured questionnaires were developed and data were collected on herd size and compositions, purpose of keeping cattle, vernacular names of cattle by sex and age categories, breed type name, other indigenous breeds known, characteristics of favorite cattle categories, and sources of breeding stock, breeding and selection methods used by cattle keepers for assessment of trait expressions. These data were analyzed by SPSS software and preferred traits were selected based on their frequency percentage. Data collected for characterization of cattle population were analyzed by SAS software. Results obtained show that the mean total cattle herd size holding in Sayyo Gamballa, Gidda Abbu and Danno Shanan PA were 12.8, 10.3 and 13.2 heads, respectively. Cattle keepers of Danno district identified nine animal categories based on age and sex of animals. They keep cattle for multipurpose functions and male and female cattle are kept for different functions.

The main purposes of keeping male cattle are traction, reproduction and income generation and those for female cattle are milk production, production of calves and income generation. In addition, farmers' preferred

traits and expressions identified through this study included physical, production and adaptation traits. The reasons for keeping cattle and the trait preferences identified reflect the multiple objectives of the livestock-keeper, with production traits, reproduction traits, physical traits and adaptive traits mentioned as important. Most of the time, farmers assess these trait expressions based on visual observation. Furthermore, farmers of the study area tried to influence their preferred trait expressions by providing different management practices for different cattle categories such as feeding and housing. The overall means and standard deviations of adult (>4 years) cattle body length (BL), heart girth (HG) and height at withers (HWT) were 97.2(6.8, 130.7(8.5 and 106.5(11.5 cm, respectively. The average mean morning milk off take of cattle at Danno was 0.6 kg. These show that there are high variations in important traits expressions of Horro cattle in the study area. The variation between targeted and actual trait expression for economically important trait expressions were attributed to different production constraints identified in the project area.

Therefore, addressing these constraints like feeding, health control and management are very essential to develop a successful genetic improvement program in this area for cattle. Finally, from this study it is concluded that the component traits need to be identified carefully before deciding what breeding or livestock development objectives should be adopted. Furthermore, the relative importance of each of these uses is relevant for research and development on cattle genetic resources of the area, because they provide the basis for setting the current and future objectives of sustainable use and genetic improvement of cattle genetic resources.

Characterization of milk production system and opportunity for market orientation: A case study of Mieso District, Oromia Region, Ethiopia

Kedija Hussen

Abstract: This study was conducted in Mieso district in western Hararghe Zone of Oromia Regional State to characterize milk production and marketing system and identify opportunity for market orientation. This study was initiated with the objectives of generating baseline data in the area of milk production and marketing system. The study was undertaken in five purposely selected rural kebeles of Mieso district; and these were Dire-kalu, Welda-jejeba, Hunde-misoma, Gena, and Huse-mendera. Farmers from each rural kebeles were selected using Proportional Probability to Size (PPS) approach for each rural kebele. A total of 120 farmers were selected based on the number of households. The sample households in each rural kebele were stratified into female and male headed households. For the market study, two market sites were purposively selected namely, Mieso and Asebot markets due to the accessibility of the area. Milk marketing was monitored over two seasons, i.e. rainy and dry seasons. The average pasture land size of the sampled households was 1 ha, with a range of 0.25–10 ha. On average, there were more number of goats (6.03 (0.30) holdings than cattle (5.69 (0.35) and camel (1.83 (0.92) per household. However, the average number of animals per species found in the studied rural kebeles was highest for goats (723), than for cattle (683) and camel (220). The proportion of female to male ratio of cattle in the district was 2.57: 1. Traditional hand milking was the major type of milking practices in all parts of studied area. During the study period, about 99.2 % of the households had milking cows, and 97.5 % of these households indicated that only female members of the household are responsible for milking. However, 2.5% of the households indicate that not only females, but also males take part in milking of cows. Almost all of the households indicated that cows are milked twice during the wet season and once during the dry season. About 72 % of the respondents indicated that camels are milked up to thrice a day during the wet and dry seasons. Milk and milk product sale (96% of the respondents) and crop sale (95% of the respondents) take the highest percentage of source of income. All the respondents indicated that cattle,

camels and goats are fed principally on communal natural pasture throughout the year. Agricultural by-products, mainly crop residues of sorghum and maize are the major feed resources in the studied area. Traditionally, sorghum and maize plantation used as fodder for livestock feed, and it is locally called as chinki. As an additional feed, mineral soil salt, locally known as “haya”, is used by 40 % of the respondents during wet as well as in the dry season.

All milk animals in the study area are indigenous breeds and have not been characterized. The overall mean (SE) age at first calving for cows and she camels were 52.49 (0.91 and 63.37 (1.55 months, respectively. The overall mean calving interval for cows and she camel were 16.01 (0.49 and 18.53 (1.02 months, respectively. The estimated mean milk yield/head/day was 1.24 (0.02 litre for cows and lactation yield per cow was 271.4 litres over an average lactation period of seven month (7.29 (0.17). Overall estimated mean camel milk yield/head/day was 2.4 (0.06 and lactation yield head was 797 litres over an average lactation period of eleven months. The estimated average total milk produced per household per day in the wet and dry seasons was 4.80 (0.22 and 2.37 (0.11 litres, respectively for cows. Similarly, the average total milk produce per household per day in the wet and dry seasons was 13.19 (0.945 and 7.63 (0.82 litres, respectively for camels. The majority of the households sell whole milk (78 %) than whey (4.2 %). Butter is produced for sale by about 67% of the respondents. About 72% of the respondents indicated that they sell cow milk during both the dry and wet seasons. The average volume of cow and camel milk sold per household per day during the rainy season was 3.55 (0.28 and 3.61 (0.45 litres, respectively. However, during the dry season, the respective volumes decreased to 2.15 (0.22 and 2.58 (0.37 litres. Cow and camel milk supply to the market decreases by 39 and 28% during the dry season, respectively. This indicates that camel milk sale increases during the dry season. The amount of milk sold in Mieso market per day was significantly (P (0.05) higher for cow (496.6 (19.12 litres) as well as camel milk (187.89 (9.12 litres) than the Asebot market site. The price of cow and camel milk during the wet season is lower (1.88 (0.10 Birr/litre and 1.63 (0.10 Birr/litre) than during the dry season (3.38 (0.10 Birr/litre and 2.98 (0.10 Birr/litre), respectively. Generally, there are two milk marketing systems; namely, traditional milk associations or groups and the producer themselves (individual seller). The traditional

milk association or group is locally known as 'Faraqa Annanni'. From the total (n=94) households who sell milk, only 22 (23%) were involved in the milk association or groups. An average amount of milk sale by group (3.94 (0.18 litre/person) were significantly ($P(0.05)$) higher than individual (1.64 (0.06 liter/person). The total amount of milk sold (litre/person/day) at the two market sites differed significantly, being higher in Mieso (3.27 (0.17 litres/person) than in Asebot (1.91 (0.06 litres/person). The number of individuals per Faraqa Annanni/day was not significantly ($P > 0.05$) different between Asebot (2.94 (0.12) and Mieso (3.05 (0.22)). However, there was a greater number of seller groups in Mieso. This may be due to the involvement of pastoral milk seller groups from the adjacent district of Mullu in Somalia Region.

As the logit regression result indicates the availability of Faraqa Annanni in the area had significant ($P(0.1)$) positive relation with the participation decision of the household to sell cow milk. The other variable which has a significant ($P(0.05)$) impact on the decision behavior of the household is its location from the market. As the model output indicates, the farther the household is away from the market centre the less will be its participation to the cow milk sale. Education level of the household heads were negatively ($P(0.05)$) correlated with participation decision on cow milk sale. This negative correlation of educational level of the household heads with participation on cow milk sale indicates that household heads focus more on other activities than on milk sale. Contrary to the expectation, the amount of goat and camel milk produced in the household were negatively and significantly ($P(0.01)$ and $P(0.1)$) related to market participation decision of the household on cow milk sale. This indicates that increased production of camel and cow milk tends to shift the household consumption pattern from camel and goat milk to cow milk, which reduces the available cow milk for sale.

Most of the respondents indicated that milk sale was highly affected by small milk quantity (73%) followed by distance to market (38%). Only 7.6% of the respondents indicated cultural taboo as a limiting factor for milk market participation. Therefore, the figure indicates that this issue is not a serious problem in the area.

Overall cattle and camel pre-weaning mortality rates were 61.7 (5.2 and 66.7)(14.7. Mortality due to diseases was identified as a major cause of loss in cattle (65% of respondents) and camels (67%) in the study area. Mastitis, Anthrax, pasteurolosis, diarrhea, Blackleg and FMD (Foot and Mouth Diseases) were the major diseases that affect cattle in the area.

Only 33 % of the respondents indicated that they have access to extension services on dairy animal production. The farmers contact with extension staff once or twice a year and there is no strong and regular visit and follow-up.

Generally, among the problems of dairy production in the area, seasonal feed and water shortage, security problem, and poor access to veterinary services were the major ones. In addition to this, low knowledge capacity and the limited number of the development agents were also reported to be common problems in the extension service. All milk animals in the study area have not been characterized. There isn't any milk cooperatives organized in the area. Instead there are traditional self-organized milk seller groups, Faraqa Annanni. Milk sale was highly affected by small milk quantity followed by distance to market. In addition, milk sale was also affected by non-availability of Faraqa Annanni in the area. Accordingly, it is necessary to improve the available natural pasture and implement rangeland management systems, and also to introduce and develop improved forages as sole crops or as forages integrated with cereal crop production. Due attention should be paid to the way of dealing with conflicts over use of resources in the district, while conflict resolution method should be addressed and the community should be a starting point for ideas to develop a strategic plan. There should be training for development agents and extension staff in the district about milk production, handling and processing techniques. It is necessary to improve animal health services through paravet training and drug supply system with close monitoring and supervision. Breed improvement should consider the multipurpose utility of local breeds, where it is feasible for improved feeding and proper management systems. Furthermore, it is necessary to establish milk collecting and processing unit through encouraging the already existing self-organized group, 'Faraqa Annanni'.

Characterization of smallholder poultry production and marketing system of Dale, Wonsho and Loka Abaya Weredas of Southern Ethiopia

Mekonnen G/Egziabher Muhiye

Abstract: A longitudinal data collection (repeated survey) and a cross sectional survey was conducted in three *weredas* of southern Ethiopia to characterize the smallholder poultry production and marketing systems thereby to identify the major constraints and priorities for poultry improvement and extension interventions. A structured questionnaire and Participatory Rural Appraisal (PRA) methods relevant to rural poultry production were used to collect data. Using a stratified random sampling technique, one hundred and sixty households were included in the survey. The result showed that the main objectives of chicken production in the study area were for sale (44%), replacement (34%) and consumption (22%) and that of eggs used for hatching (47%), sale (33%) and home consumption (20%). The most dominant chicken production system in the study area was a subsistence extensive system which is based on indigenous chicken with scavenging and seasonal supplementary feeding of homegrown grains and household food refusals. The overall mean flock size for the three *weredas* was 9.22 ± 0.35 with a range of 3–26. Nearly all (97.6%) of the respondents do not have a separate house for their chicken and only 10% of the respondents have access to veterinary services. Poultry production was managed based on indigenous or local knowledge they have acquired over their lifetime. The high hatchability (89.1%) and mortality (80%) are the two conflicting features of the system. Men and women took 35 and 24.4% ownership respectively. The major decision role belongs to men while the major management was the responsibility of women. The overall average age at first egg was 7.07 ± 0.08 ranging between 5–10 months. The average egg production per clutch was 14.9 ± 0.23 ranging from (6–26) with a mean 3.7 ± 0.04 clutches per year ranging between 2–5 clutches with a clutch length of 26.2 ± 0.41 days. The overall mean cock: hen ratio was 1:2.2. Chickens in Wonsho (Dega) *wereda* showed significantly ($p < 0.05$) best performance with the highest egg production (62.95 eggs/hen/year), lowest chick mortality (45.15) and highest clutches per year (3.8) compared to other *weredas*. The mean live-weights for matured male and female at farm gate were 1.58 ± 0.02

(kg) and 1.30 ± 0.02 (kg), respectively. The corresponding price for matured male and female at farm gate were 21.74 ± 0.54 and 13.95 ± 0.43 birr, respectively, during ordinary days. More than half of the respondents (65%) do not have any information about the price of the chicken. Only 31.67% of the volumes of sale pass directly to the consumer. Critical constraints of the smallholder poultry production in the study area were partly due to the prevailing poor management practices, in particular predation, lack of proper health care, and poor housing. It was concluded that efforts have to be made to shift the production paradigm to semi intensive type focusing on market-oriented production based on scavenging with a holistic support of services such as health, housing, extension, credit and marketing to make it productive and sustainable.

Key words: Indigenous chicken, scavenging, chicken production and marketing systems, marketing channel.

Dairy production, processing and marketing systems of Shashemene-Dilla area, South Ethiopia

Sintayehu Yigrem

Abstract: Two hundred dairy producers, both rural and urban producers of the four major towns representing Shashemene-Dilla area were selected with multi-stage sampling techniques, with the objective of characterizing dairy production, processing/handling, marketing systems as well as to prioritize constraints and opportunities of dairying in the area. To characterize dairy marketing systems in the studied areas RMA technique was employed on key dairy marketing observers. Dairy producers were interviewed on different aspects of dairying with a pre-tested and structured formal questionnaire. Dairy marketing systems were studied with the help of topical guidelines.

Two major dairy production systems namely the urban and mixed crop/livestock systems were identified and again classified into two based on the major crops grown as a cereal crop producing and enset-coffee producing areas. The average family size of the urban producers was 7.19 ± 0.26 while that of rural producers was 7.58 ± 0.23 persons. Dairy production contributed about half of the income of urban producers but it made up only 1.6% of the total income of families in the mixed crop/livestock production system. Average farm size of households in the mixed system was 1.14 ± 0.99 ha. while more than 97% of urban producers use their own residence compound for dairying, which is only 200– 400 square meters. Average herd size in the cereal based mixed system (3.8 ± 0.42) is more than in the enset–coffee based systems ($2.3 \pm .36$ heads/HH). Out of the total herds of urban producers, 32% of the cattle were local cows while 19% were crossbred cows. Both reproductive and productive parameters like AFM, AFC, DMY and LCC of Zebu/local cattle were significantly ($P < 0.001$) affected by production systems. CI and LL were also significantly affected ($P < 0.005$) by the same factor. These parameters significantly differed by breed types (AFM, AFC, and DMY at $P < 0.001$) and management practices in the four towns (AFM, AFC, CI, DMY, LCC, and LL at $P < 0.05$). The overall mean AFM, AFC, CI, LL, DMY, and LCC zebu/local cattle in all systems were 41.75 ± 0.7 months, 19.84 ± 0.36 months, 2.07 ± 0.09 litres, and 7.26 ± 0.16 calves, respectively; while the overall values for urban

system were 25.51 ± 0.92 months, 36.32 ± 0.99 months, 15.89 ± 0.44 months, 9.3 ± 0.27 months, 7.35 ± 0.48 litres, and 6.89 ± 0.23 calves, respectively.

Husbandry practices like feeding, watering, housing, breeding, milking, calf rearing, waste management and records keeping were also different among production systems identified in the studied areas. An estimated total of 9,645,020.3 litres of milk was produced annually from 4,463 small and medium farms in the four towns. The majority of producers (61.7%) in the mixed crop/livestock system process milk at home, while the majority of urban producers (79.2%) produced milk for sale. An informal dairy marketing system was the only marketing system in the area. Different market channels and market outlets were identified for different dairy commodities, butter being the one having the longest channel. Prices of dairy commodities were influenced by different factors like seasonality, access to market/distance from towns, fasting and non fasting days, festivals and holidays, level of supply versus purchasing ability of the urban dwellers and quality of dairy products. Constraints of dairy development in the area included, availability and costs of feeds, shortage of farm land, discouraging marketing system, waste disposal problems, genotype improvement problems, poor extension and animal health services, and knowledge gap regarding improved dairying. The rapid urbanization, subsequent increase in human population and standard of living of the urban dwellers especially the regional town Awassa as well as the rest three zonal towns can be considered as a good prospect for the development of dairy in the area. Dairying in the studied areas can be improved by solving major problems of smallholder dairy producers, through services related to feed supply, land, good marketing systems, allocating place for waste disposals and through provision of veterinary, AI, credit, extension and training services at reasonable time and cost. Moreover, as market is the deriving force to the production and productivity of dairying, encouraging private investors to establish dairy processing plant in the area may be an option as permanent market places for milk and thereby rural and urban producers like Addis Ababa milk shed will be encouraged to enter into milk collection schemes.

Demand for small ruminants' meat in the Sudan

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Abstract: Despite the fact that Sudan is considered one of the richest Arab countries in livestock which exceed 136 million heads of different animals in 2005, however, the domestic market for meat suffers from high prices so that the consumer cannot obtain his share of the different meats . This emphasizes the fact that there is a problem in the process of meat marketing.

This research deals with the domestic demand for small ruminants' meat in Sudan. The main goal of this study is to identify and determine the most important factors that affect the consumer's demand for this significant food commodity and to propose the appropriate solutions for it.

This study depended on primary and secondary data which fall in five chapters. The first chapter tackled the research problem, objective, hypotheses and methodology. The second chapter includes the general theory of demand in terms of its economic meaning, elasticity and the factors that affect it. The third chapter is about the analysis of the secondary data in terms of available potentials of livestock number and potential development, important animals for meat production, geographical distribution, sources of animals feed and meat supply in general.

The study results indicate that there is a potential in the local market to offer the required supply of small ruminants meat with a surplus for export if present obstacles could be over come.

The primary data in the fourth chapter was based mainly on a survey conducted in Khartoum and Gedarif States in order to reach the basic determinants that affect demand for small ruminants' meat by taking a random sample of 207 households distributed between the rural and urban areas in both states.

The survey data have been analyzed by using the descriptive statistics. The different relationships obtained from the descriptive analysis was used in

regression model, the best possible model that shows the relationship between the quantity demanded in small ruminants meat and a number of variables.

The study further showed the most important factors that affect meat consumption, including economic, social and organizational factors. The economic ones involved the size and number of household members, occupation of the head household breadwinner, level of income, prices of the commodity and prices of their alternatives. The social factors involved the educational level and the social status which reflects on the demand for meat. The organizational ones included the preparation of meats. The study also discussed the patterns of meat consumption taking into consideration the types of meat consumed by families and expenditure on it.

The results of the analysis indicated that the price of commodity and income are the variables that affect the demand for small ruminants' meat. The relationship between quantity demanded and the price is negative, while the relationship between the quantity and income is positive. The results also indicated that the income elasticity of demand for small ruminants meat is about 0.119, while the price elasticity of demand is -2.872 , -2.659 for Khartoum and Gedarif States, respectively.

The last chapter of the study includes some suggestions and recommendations that could contribute to solving some of the problems identified by the study, and in the development of marketing system of small ruminants' meat to coincide with the great potential of the Sudan in small ruminants' meat production.

Determinants of adoption of improved box hive in Atsbi Wemberta District of Eastern Zone, Tigray Region

Workneh Abebe

Abstract: Though beekeeping is a common farming enterprise and income generating activity in Atsbi Wemberta, and promotional efforts were made to improve it, no systematic study has been undertaken to evaluate the promotional efforts and people's response to it.

The objectives of the study were to identify determinants of improved box hive adoption by the beekeepers; and to analyze financial benefits of adopting improved box hive technology in Atsbi Wemberta district of Eastern Zone, Tigray Region of Ethiopia. Stratified sampling technique was employed to identify the sample respondents. The sample respondents were categorized into adopters and non-adopters of improved box hive. Based on probability proportional to size, 45 adopters and 85 non-adopters were identified out of 130 total sample respondents.

The data were collected using structured interview schedule, group discussion, key informant discussion and observation; and were analyzed using descriptive statistics, partial budgeting, and logit model. The logit model reveals that credit, knowledge, education level of household head, perception and demonstration visits were positively and significantly influencing adoption of improved box hive, whereas age, family size, extension contact, market availability and beekeeping training were not significantly influencing adoption of improved box hive. Concerning financial benefit, partial budgeting result reveals that the beekeepers benefited by adopting improved box hive. The total net benefit from improved box hives exceeds the benefit from traditional hive by more than twice.

The major problems for promoting improved beekeeping practices were identified in the study area. Ranking revealed that drought; honeybee pests and disease; lack of beekeeping materials; death of colony; lack of extension support; marketing problem; shortage of bee forage; lack of beekeeping skill and reduction of honeybee colonies were found to be the major constraints

in the beekeeping development of the district in their order of importance. Cost of improved box hive was also found to be one of the determining factors for the technology promotion. Hence, it is recommended that beekeeping extension, research and NGOs should enhance research and extension activities on absconding management, selecting moisture stress-tolerant bee forage, developing a technology from locally available materials, promotion of ant protection methods and organizing apiary demonstration.

Determinants of adoption of improved haricot bean production package in Alaba Special Woreda, Southern Ethiopia

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Abstract: Haricot bean is considered as the main cash crop and protein source of the farmers in many lowlands and mid altitude zones of Ethiopia. The country's export earning from haricot bean exceeds that of other pulses such as lentils, horse bean and chickpea. Low production and productivity, which are mainly associated with poor adoption of improved technologies and poor marketing system, were among the major problems. Adoption of improved technologies is one of the most promising ways to reduce food insecurity in Ethiopia. However, the adoption and dissemination of these technologies is constrained by various factors.

To this end, the aim of this study was to empirically examine factors affecting adoption and intensity of adoption of improved haricot bean production package in the study area. A two stage sampling procedure was followed to select rural kebeles and households for the study. Four rural kebeles were selected purposively, and 160 household heads were selected randomly using probability proportional to size sampling. Structured interview schedule was developed, pre-tested and used for collecting the essential quantitative data for the study from the sampled households. Focus group discussion was used to generate qualitative data. In addition, secondary data were collected from relevant sources such as *woreda* office of agriculture and rural development and others.

The result of the study indicated that the majority of farmers in the study area preferred local variety over improved one because of local market and consumption demand. Moreover, farmers' practice was found largely to deviate from research and extension recommendations. The result of the econometric model indicated that household head's attitude towards haricot bean production technology package, participation in extension event (participation in training and field visit) and access to credit were important

variables which had positively and significantly influenced adoption and intensity of adoption of improved haricot bean production package. Whereas perceived relative disadvantage of technology attributes of the household head had shown negative relationship with adoption and intensity of adoption, some farmers who previously adopted improved haricot bean varieties have discontinued planting the varieties mainly due to market problem.

The overall finding of the study underlined the great importance of institutional support in the areas of extension, credit and market to enhance adoption of improved haricot bean production package. Therefore, policy and development interventions should give emphasis to improvement of such institutional support system so as to achieve wider adoption, increased productivity and income to small scale farmers.

Determinants of participation in dairy market among agricultural households in Cote D'Ivoire

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Abstract: This thesis makes contributions to the literature on dairy market participation in developing countries. First, it gives a rare look at dairy market participation in West Africa. Second, it provides empirical analysis of the performance of the rural dairy market in Cote d'Ivoire and derives some implication for public policy in the design and evaluation of dairy development projects. Third, it is the first dairy market participation study that investigates endogenous livestock ownership and market inferences of public policies to the larger population of cattle non adopters.

A Heckman sample selection model was applied to a population of 185 agricultural households in Cote d'Ivoire to capture the discrete decision of livestock ownership and the continuous sales of milk. Maximum likelihood estimates were obtained for cattle ownership and milk sales equations.

Econometric results confirm that there is significant bias if one ignores the population of cattle non-adopters. These findings are highly important in light of the widespread application of two step selectivity models on the limited population of livestock producers. An inference is that existing estimates of the determinants of market participation may be biased.

Results also suggested the need to draw policy recommendations taking into account the larger population of agricultural households. Indeed, policies that influence higher milk prices and lower transactions will have a positive impact not only on the volume of marketed surplus supply by livestock owners, but also on the propensity of rural agricultural households more broadly to the adopt cattle.

Economic analysis of current tsetse and trypanosomosis control practices and *ex-ante* assessment of potential demand of a new tsetse control technology in Kajiado and Narok Districts

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Abstract: Optimal livestock production, a major source of livelihood among pastoralists in Kenya, is constrained by livestock diseases such as trypanosomosis. Tsetse-transmitted trypanosomosis is a disease of both humans and animals caused by infection with the trypanosome parasite. Several farmer-based technological advances to control the disease have been made in order to control the disease, and are already available for farmers to use. In addition, a new tsetse-repellent technology (TFRT) has been developed and will undergo epidemiological and economic evaluations in project proposed sites of Kajiado and Narok Districts. The purpose of the evaluation is to determine its appropriateness, viability and efficacy. However, the suitability of the trial sites in addition to the potential demand of the technology among target farmers was not clearly understood. This study sought to assess both suitability of study area for TFRT on-farm trials and its potential demand among the target farmers. This was achieved through identification and economic analysis of livestock disease constraints and Tsetse and Trypanosomosis Control Technologies (TTCT) currently being used by farmers in the study area. Specifically, factors that influence perceptions of disease constraints, especially trypanosomosis, as well as demand for trypanocides, and adoption of synthetic pyrethroid dip-wash insecticides for tsetse control were established. In addition, farmers' preferences for tsetse and trypanosomosis control technology attributes were evaluated. The analysis was applied in the context of a pastoralist production system in the Kajiado and Narok tsetse belt in Kenya, which is characterized by low-input management, low literacy levels, exposure of livestock to a number of tropical diseases and existence of several disease control options, both traditional and improved. Data was collected through both participatory rural appraisal and household-survey of a random sample of 186 livestock farmers in Mara and Magadi Divisions in Narok and Kajiado Districts, respectively. Logistic

and ordinary least squares regressions and conjoint analysis were the main econometric models employed. Results showed that trypanosomosis was the most prevalent disease in the study area, followed by tick-borne diseases and Foot and Mouth Disease. However, the relative importance of trypanosomosis compared to other diseases significantly differed between the two Divisions. In Magadi, tick-borne diseases were perceived as relatively more important as trypanosomosis while in Mara the latter was equally important as tick-borne disease. While chemotherapy was the commonest method of its control, there was poor adoption of tsetse control pyrethroid-based insecticides especially in Mara, which was attributed to high costs of the insecticides, low literacy levels and low awareness of the technology resulting from weak institutional support. The farmers' preferred highly effective, preventive, cheap and easy-to-use TTCT that do not require any technical assistance to apply. The analysis of disease constraints and grazing practices showed that TFRT was relevant to the farmers' disease constraints and was compatible with the production system which rendered the study area suitable for its on-farm trials. Necessary conditions for TFRT potential demand were fairly satisfied but sufficient conditions such as adequate extension, its ability to compete with trypanocides and match farmers' preferences for TTCT attributes need to be met for the technology to enjoy potential demand. The study recommends three things: one, commencement of farmer managed on-farm trials; two that TFRT attributes be adapted to farmers' preferences of high efficacy and relatively low price before releasing to the market and the technology should be user friendly to enable farmers apply it to the animals without having to seek technical assistance to do so; thirdly, extension education services to the target farmers should be improved to enhance adoption of insecticides, while at the same time addressing the misuse of trypanocides.

Economic analysis of smallholder agricultural production under conditions of risk: The case of Vihiga and Kilifi Districts in Kenya

Kuyiah JW

Abstract: This study investigates how risk affects production decisions of smallholder farmers in Vihiga and Kilifi districts. It further explores the possibilities of raising farm production and income under existing conditions in the study sites. Knowledge of how these farmers make production decisions under conditions of risk and uncertainty are important in the development of appropriate strategies necessary to drive agricultural intensification and development in the smallholder sector to match rising aggregate food demand. Gross margin analysis is done to establish the relative competitiveness of key enterprises and efficiency of resource use on the enterprises and efficiency of resource use on the surveyed farms. Coefficients of variation of yields, price and gross margins of the various enterprises are estimated to give an indication of the risks associated with the production of these enterprises. Linear programming analysis is used to identify optimal farm plans feasible with the given set of farm resources endowments and constraints. MOTAD analysis is done to generate a feasible set of risk-efficient farm plans that can be used as a guide to minimize production risks at farm level. Results indicate that the presence of yield and price risks, coupled with the desire for food self-sufficiency lead to sub-optimal resource allocation at farm level. The findings also show that there is scope to increase farm income and reduce risks through investing in high-value crop and livestock enterprises. In the absence of credit and insurance, livestock and non-farm income may offer a viable alternative in risk mitigation and overall farm development. Cash constraints and small land sizes are the two most important factors that inhibit realization of higher farm incomes and optimal production at farm level. There is need for policies that spur investment in public infrastructure, rural financial markets, private investment, and support institutions to address the problems of high transaction costs to investors, and reduce risks faced by farmers.

Effects of pastoralism and protection on lion (*Panthera leo*) behavior in the Masai Mara National Reserve and the adjoining Koyiaki Group Ranch

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Abstract: Human–wildlife conflicts are an ever increasing problem for many species of wildlife throughout the world, especially true for large carnivores. They are often killed when threatening humans and their domesticated animals, and since carnivore’s trophic positions constrain them to living at low population densities, their future existence is critically threatened. Lions (*Panthera leo*) living outside protected areas in proximity to Maasai pastoralists also experience reductions in numbers when getting too close to or when attacking people and their livestock, either directly by getting killed by Maasai herders or indirectly by being chased away to less suitable habitats experiencing a reduction of their prey base. As these populations decline in pastoral areas due to increasing human predation, expansion of human population numbers and settlements, habitat loss and alteration, successful conservation of viable populations of large carnivores is becoming increasingly complex and difficult. Little is known about the behavioral ecology and population status of lions living outside protected areas.

This study aims at improving our understanding of how pastoralism modifies lion behavior. More specifically, this study aims at finding out when and where and for how long protected and unprotected lions are inactive/active during both a wet and a dry part of the year. It also aims at eliciting the local people’s views on lions and their behavior in the ranches, on the general conflicts with predators, how and when they kill lions and recent historical changes in lion behavior in the ranches. Lions are the only cats that live and hunt in truly stable social groups, also known as prides. These prides are typically composed of 2–18 adult females, their dependant offspring and a coalition of about 1–9 adult males. Pride members may associate into small sub-groups within the home range.

All pride members are strongly territorial, and pride areas average 20 to 500 km². When lions are 3–4 years old, the sub-adult males form coalitions of 2–3 individuals and leave their natal prides to seek new ones. Females usually continue life within the pride. Africa's lion population has declined over the last 30 years from more than 75 thousand to about 15 thousand–30 thousand individuals concentrated mostly in central and eastern Africa making it critical to understand the cause of these declines. I collected data on lions in Kenya living inside the Masai Mara National Reserve and in one of the adjoining privately owned group ranches. One female lion living outside the reserve was radio collared to ease location of a pride of unprotected lions. I made observations in the morning and evening hours recording lion behavioral activities, habitat type occupied, lion visibilities, weather conditions and behavior after a kill. For each group, GPS coordinates of lion locations at the beginning and at the end of every observation was recorded to estimate the prides minimum home range sizes. Comparisons between individuals within a pride and between the prides for inactivity/activity for morning and evening hours and for light and dark hours were made. Daily activity patterns, visibility at observation start, behavior after a kill and minimum home range sizes were also analyzed. A questionnaire concerning the local people's attitude toward carnivores was administered. Disturbance and conflicts with humans seemed to primarily influence lion movement and activity patterns.

The results showed that there was no difference between prides in relation to the mean times they were inactive or active, except when the unprotected lions were severely disturbed during which time they were significantly more active during the dark periods. There was a difference between the protected lions inside the reserve and the unprotected lions in the group ranch where they ate their prey and whether or not lions stayed with a carcass or came back to a carcass during the very dry period. There was also a difference between the protected and unprotected lions in how visible they were and the habitats lions occupied over time. The activity budgets for all the prides were roughly the same. The behavior of the unprotected lions seemed to be indirectly determined by weather conditions and directly by human and livestock activities. During the very dry period when livestock occupied bushes, plains etc., the lions became completely nocturnal concentrating their activity in and around thickets and bushes, or they were pushed to hills (areas of their

home ranges in Koiyaki) and associated in smaller groups that were harder to locate at daylight. After the rains started and grass began to grow, livestock were herded mostly on the plains. Consequently, the lions became active earlier and were often on the open plains. The unprotected lions were often visible lying at the edges of bushes during daytime. Group sizes increased and were sometimes as large as the total pride size. A general negative view by the respondents was associated with lions. Adult lions seemed to have altered their behavior not in what they did, but in where and when they did it. Lions will most likely continue to decline in Koiyaki if the Maasai population and settlements continue to increase, local attitudes towards lions do not change and do not make a better effort to prevent loss of livestock by increasing livestock protection.

Effectiveness of agricultural development training program: The case of teff and livestock farmers of Alaba woreda

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Abstract: This study was intended to examine the effectiveness of teff and poultry farmers' training process and outcomes in Alaba *woreda*. It was conducted in four kebeles through survey and qualitative method. The survey was undertaken on randomly selected trained and untrained teff and poultry farmers. The qualitative methods that were used at community, organizational and individual levels include: document review, focused/group discussion, personal interviews, and direct observation, and different tools such as, SWOT/force-field analysis, ranking, scoring, and rating. The data that are related with the training, context, process, changes in performances, and outcomes were collected and analyzed qualitatively and through descriptive analytical statistics and the chi-square.

The results of the study revealed that: the gaps between the contents of the trainings and the identified needs of farmers were very wide because of lack of participatory need assessment. Training plan is based on quota from above; expected changes in performances are not indicated in the objectives, thus they are vague, incompatible and difficult to measure. Topics are very general and shallow, not thoroughly touching the prior needs of the farmers. Mostly, the training mix is more of theory while few practical, non-interactive long lectures (talk) are used as one of the most commonly used methods. The urgency of trainings makes selection of participants "urgent" and creates unfair nomination, which is also affected by 'informal' criteria (personal relations and political outlook) and gender-related biases. Conveniences of farmers in the arrangements of time and places of trainings are not considered genuinely and thus trainings can be undertaken at peak cropping periods outside of their kebeles. These make the participation of women difficult and/or impossible because of their multiple responsibilities. Thus, most of the trainings are male-biased. The group size is too large, and participation of farmers is very passive.

Monitoring and evaluation of trainings did not exist and measurements of participant's reactions, learning, changes in on-the-job performances and outcomes of trainings have not been undertaken systematically. Farmers' responses indicate differences in KS among trained and untrained farmers that have been observed only in few job tasks. Although it is difficult to give the actual changes directly brought by trainings, the majority of the farmers in the study indicated that there is change in productivity of teff and poultry because of improved variety and exotic breeds, respectively. The study also revealed that change agents' training process was defective in planning, implementation, as well as monitoring and evaluation aspects. Thus, to effectively implement participatory performance-based trainings, that are related with the actual work situations of the clients and that are aimed at achievable learning objectives, improvements through joint or participatory (bottom-up) planning, effective implementation, follow-up and evaluation activities must be considered starting from farmers/FTCs level. The following interventions are therefore recommended as a way out; inclusion of training activities properly in the performance appraisal and evaluation system of the organization with relevant performance measurement indicators; building capacity of the stakeholders in participatory planning, implementation monitoring and evaluation activities of the rural development and extension activities as a whole and in participatory training methodology (PTM) in particular; gradual implementation of the FTCs, i.e. starting with small number to learn from; and building on the experiences obtained, and in general shifting the approach to participatory methodologies.

Evaluation and characterization of CD4⁺ T Cell Responses to *Theileria Parva* vaccine candidate antigens

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Abstract: East Coast Fever (ECF) is a fatal disease of cattle caused by *Theileria parva*, an intracellular haemoprotozoan parasite. Immunity in cattle immunized against *T. parva* using the infection and treatment method (ITM) is mediated by parasite-specific CD8⁺ cytotoxic T lymphocytes (CTL) that destroy schizont-infected cells. Ten schizont antigens (Tp1-Tp10) recognized by CD8⁺ CTL have been identified and vaccine potential of six of these has been evaluated. Initial results have shown a significant correlation between CD8⁺ CTL responses and survival after challenge, but CTL responses have only been induced in a proportion of vaccinated cattle. Since CD4⁺ T cells play a crucial role in the induction of naïve CD8⁺ T cell responses, it may be critical to incorporate antigens that contain CD4⁺ helper T cell epitopes in such a CTL-targeted vaccine. This work aimed at determining whether six of the CD8⁺ CTL-targeted vaccine candidate antigens contain CD4⁺ T cell epitopes and to establish whether cattle immunized by ITM mounted CD4⁺ T cell responses to these antigens. Peripheral blood mononuclear cells (PBMC) obtained from ITM-immunized cattle or those that had recovered from challenge infection following immunization with the candidate vaccine antigens, were used to generate antigen-specific CD4⁺ T cell lines by repeated stimulation with autologous *T. parva* infected cells (TpM) or pools of overlapping synthetic peptides. Screening and mapping of CD4⁺ T cell epitopes was carried out using both lymphocyte proliferation and TET-γ ELISpot assay. Two TpM-stimulated CD4⁺ T cell lines, generated from ITM-immunized animals, did not recognize any of the CTL target antigens. However, *ex vivo* CD4⁺ T cell responses were detected to Tp1, Tp4, Tp5, Tp6 and Tp8 following immunization with CTL target antigens and challenge with *T. parva* sporozoites. CD4⁺ T cell lines specific to antigen Tp1 were generated from one of these animals (BZOO1) by stimulation with synthetic peptides and two antigenic peptides mapped on Tp1 (Tp1₁₄₅₀₋₁₄₅₉ and Tp1₁₉₈₃₋₁₉₉₂). Interestingly, this CD4⁺ T cell line recognized the recombinant Tp1 protein but did not respond to autologous schizont infected cells. The results of this study indicate that the CTL target antigen Tp1 contains CD4⁺ T cell

epitopes which are sub-dominant or if dominant, are not sufficiently expressed on the surface of schizont infected cells. This work also suggests the need to develop methods of screening for CD4⁺ T cell antigens from *T. parva* that could be used to identify novel, immunodominant antigens presented on *T. parva* schizont infected cells that may enhance the potency of the sub-unit vaccine under development.

Evaluation of economic efficiency of tick control practices among smallholder dairy farmers in Kenya

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Abstract: East Coast fever (ECF) is a highly fatal lympho-proliferative disease of cattle caused by tick-borne protozoan *Theileria parva*. The intra-lymphocytic schizont stage induces a cancer-like transformation of the infected cell which is responsible for the pathology and ultimately death of infected animals. Immunity from the cattle that recover from ECF or treated using live vaccines is mediated by parasite-specific CD8⁺ cytotoxic *T lymphocytes* (CTL), which target and clear schizont-infected lymphocytes. Although the identified CTL target antigens have been evaluated using DNA and attenuated pox virus vectors and have been shown to induce CD8⁺ CTL responses in a proportion of cattle that have correlated with reduced disease severity upon parasite challenge, the inability to consistently trigger the protective CTL responses is a major impediment that needs to be overcome. This study aimed at evaluating the potential of recombinant live attenuated *Listeria monocytogenes* (*Lm* $\Delta actA\Delta inlB$) expressing three defined *T. parva* CTL epitopes to stimulate protective CTL responses against *T. parva* in cattle upon lethal parasite challenge. *In vitro* studies using recombinant *Lm* $\Delta actA\Delta inlB$ indicated that one of the *T. parva* CTL epitopes could be weakly expressed and recognized by antigen-specific CD8⁺ T cell lines in one of the experiments. Cattle were screened against *L. monocytogenes* T cell target antigenic peptide pool, listeriolysin-O (LLO), and the vaccine select animals based on those with no or low background responses to LLO. Induction of epitope-specific CD8⁺ T cell IFN- γ immune responses were detected in three out of nine vaccinated animals while T cell responses in PBMC to LLO were observed in eight animals immunized with either wild type or recombinant *Lm* $\Delta actA\Delta inlB$. Cytotoxic T cell responses were detected after boosting in only one of nine immunized animals. However these responses did not translate into a significant protective effect after challenge. This may be in part due to poor expression of recombinant antigens leading to sub-optimal induction of protective antigen-specific CD8⁺ T cells. Although this immunization regime failed to induce protective CD8⁺ T cells against *T. parva* in all the animals. By modifying the

antigen formulation, dose, mode and route of inoculation a more efficient protocol can be developed. This kind of formulation will find application in vaccine preparation in other diseases including cancer where the induction of CD8⁺ T-cell immunity is critical.

Evaluating of fusing a cell penetrating peptide to *Theileria parva* antigens on the induction of CD8 + Cytotoxic T Lymphocyte response

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Abstract: East Coast Fever (ECF) is a tick transmitted protozoal disease of cattle confined to eastern, central and southern Africa. It is caused by an intracellular apicomplexan parasite *Theileria parva* which is transmitted by the brown ear tick *Rhipicephalus appendiculatus*. The disease threatens the livelihoods of many poor African livestock farmers and it constitutes a major constraint to dairy industries. It is estimated that the disease kills 1.1 million cattle each year in Africa with losses estimated at US\$ 168 million. Control of ECF is mainly dependent on the use of acaricides, drugs and a live vaccine. However increasing prevalence of acaricide resistance in tick populations coupled with the high cost and cold chain requirements of the live vaccine has intensified the search for alternative control measures. Efforts are being focused on the development of a cheap and easy-to-deliver vaccine based on components of the parasite. Immunity to *T. parva* is associated with major histocompatibility complex class I (MHC-I) restricted CD8⁺ cytotoxic *T lymphocytes* (CTL) that kill lymphocytes infected with the schizont stage of the parasite. Parasite antigens recognised by MHC-I restricted CD8⁺ CTLs are therefore logical candidates for a subunit vaccine. A number of *T. parva* vaccine candidate antigens have been identified that are the targets of CTL from immune cattle. Vaccination of cattle with recombinant DNA and viral vectors expressing these antigens have been shown to induce protective CD8⁺ CTL responses in a proportion of cattle. However an effective delivery strategy that consistently induces protective CTL responses remains to be identified. This study was aimed at determining whether fusing the CPP from HIV-1 TAT to CTL target antigens from *T. parva* vaccine candidate antigens enhances the stimulation of bovine CD8⁺ CTL responses *in vitro* and induction of murine CD8⁺ CTL responses *in vivo*. Bovine *in vitro* experiments were carried out to assess the stimulation of CTL responses and a spectrum of MHC Class I biochemical inhibitors were used to investigate the MHC-I processing and presentation pathway utilized. An experiment was conducted in mice to assess the ability of CPP-antigen fusion proteins to

stimulate CTL responses *in vivo*. ^{111}In release and ELISpot assays were used to evaluate CD8⁺ CTL responses. Analysis of variance and T-test were used to compare the differences in immune responses between the experimental groups. This study has contributed to the understanding and development of vaccination strategies for the delivery of CTL targeted *Theileria parva* antigens.

Evaluation of functional traits in Holstein-Friesian cattle on large scale farms in Kenya

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Abstract: The use of imported semen within the Holstein-Friesian population in Kenya has contributed to increases in milk production per cow. However, information on how this impacts on functional traits, particularly early life survival and reproductive traits of dairy cattle, is lacking. This study evaluated age at first calving (AFC), survival to age at first calving (SAFC), and survival to four years of age (S1460) in the Holstein-Friesian cattle populations of four medium to large-scale dairy farms in Nakuru district of Kenya. The records used were for the period 1990 to 2003. Environmental factors were evaluated for all the three traits, and genetic parameter estimates obtained for AFC. The average AFC was 1058 ± 159 days with a heritability estimate of 0.15 ± 0.06 . On average, daughters of dams with sires originating from New Zealand and Australia had an earlier AFC (907 days) relative to those with sires from Europe (1031 days). To evaluate SAFC and S1460, a survival analysis was carried out using the survival kit. On average, 25% of all the animals born on the four farms were culled prior to attaining a first calving. While the highest proportion of losses was due to unspecified reasons, the relative risk of being culled was highest when an animal had a specific disease. The first 60 days of life were the most critical for early survival. The herd, year-season of birth and sire region of origin significantly ($p < 0.001$) affected mortality and culling rates. Daughters of sires from South Africa and Israel tended to have better survival rates than those with sires originating in other regions. From the analyses, it was evident that some unfavourable selection was practiced towards animals sired by Kenyan-born bulls. To facilitate accurate assessment of causes of mortality and culling, record keeping on health management is important. The use of sires from heterogeneous sources without a clearly defined breeding objective other than increased milk production potential is negatively impacting on early survival of Holsteins on large-scale dairy farms in Kenya. Economic implications of losses before attaining a productive age need to be evaluated in order to formulate intervention strategies for livestock producers to make informed decisions on choice of sires for breeding.

Evaluation of T cell recognition of *Theileria parva* homologs of Apicomplexan Antigens

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Abstract: East Coast Fever is a severe lymphoproliferative disease of cattle caused by the intracellular protozoan *Theileria parva* from the family Apicomplexa CD8⁺ cytotoxic *T lymphocyte* that constitutes the dominant protective immune response following exposure to infection or vaccination using a live infection and treatment protocol. Appropriate delivery of parasite antigens targeted by CTL from *T parva* immune cattle has long been proposed as a strategy for the development of a subunit vaccine that would contribute substantially to a sustainable integrated ECF control program. Gene homologs encoding antigens from other apicomplexan parasites constitute a source of vaccine candidate antigens. The aim of this study was to evaluate the recognition of *T parva* homologs of known apicomplexan antigens by CD8⁺ and CD4⁺ T lymphocytes isolated from cattle immunized by a live vaccine. Eight *T parva* homologs of apicomplexan antigens were sub-cloned into a eukaryotic expression vector and transiently transfected into bovine antigen presenting cells (APC). Recognition of transfected APC by *T parva* specific CD8⁺ CTL lines was assessed using an IFN- γ ELISpot assay but none of the 7 CTL lines tested recognized any of the homologs. A recombinant protein was generated representing a truncated version of one *T parva* protein designated X9-3 (a homolog of *T Complex Protein-1* zeta subunit in *Babesia microti*) and tested in immunoassay for recognition by T cells from immune cattle. Peripheral blood mononuclear cells from 3/12 cattle and a *T. parva* specific polyclonal CD4⁺ T cell line from immune cattle BW014 responded to the X9-3 protein. The results suggest that none of eight homologs genes are CTL target antigens but X9-3 is a candidate T-helper cell target antigen and should be considered for inclusion in a subunit vaccine against ECF.

Evaluation of the vaccine potential of recombinant live attenuated *Listeria monocytogenes* expressing CD8⁺ T cell epitopes of *Theileria parva* in cattle

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Abstract: East Coast Fever (ECF) is a highly fatal lympho-proliferative disease of cattle caused by tick-borne protozoan *Theileria parva*. The intra-lymphocytic schizont stage induces a cancer-like transformation of the infected cell which is responsible for the pathology and ultimately death of infected animals. Immunity from the cattle that recover from ECF or treated using live vaccines is mediated by parasite-specific CD8⁺ cytotoxic T lymphocytes (CTL), which target and clear schizont-infected lymphocytes. Although the identified CTL target antigens have been evaluated using DNA and attenuated pox virus vectors and have been shown to induce CD8⁺ CTL responses in a proportion of cattle that have correlated with reduced disease severity upon parasite challenge, the inability to consistently trigger the protective CTL responses is a major impediment that needs to be overcome. This study aimed at evaluating the potential of recombinant live attenuated *Listeria monocytogenes* (*Lm* $\Delta actA\Delta inlB$) expressing three defined *T. parva* CTL epitopes to stimulate protective CTL responses against *T. parva* in cattle upon lethal parasite challenge. *In vitro* studies using recombinant *Lm* $\Delta actA\Delta inlB$ indicated that one of the *T. parva* CTL epitopes could be weakly expressed and recognized by antigen-specific CD8⁺ T cell lines in one of the experiments. Cattle were screened against *L. monocytogenes* T cell target antigenic peptide pool, listeriolysin-O (LLO), and the vaccine select animals based on those with no or low background responses to LLO. Induction of epitope-specific CD8⁺ T cell IFN- γ immune responses were detected in three out of nine vaccinated animals while T cell responses in PBMC to LLO were observed in eight animals immunized with either wild type or recombinant *Lm* $\Delta actA\Delta inlB$. Cytotoxic T cell responses were detected after boosting in only one of nine immunized animals. However these responses did not translate into a significant protective effect after challenge. This may be in part due to poor expression of recombinant antigens leading to sub-optimal induction of protective antigen-specific CD8⁺ T cells. Although this immunization regime failed to induce

protective CD8⁺ T cells against *T parva* in all the animals. By modifying the antigen formulation, dose, mode and route of inoculation a more efficient protocol can be developed. This kind of formulation will find application in vaccine preparation in other diseases including cancer where the induction of CD8⁺ T-cell immunity is critical.

Genetic characterization and conservation of indigenous Kenyan sheep populations

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Abstract: Small ruminants play a major role in the resource-poor indigenous people and pastoralist set-up. In traditional management systems in the tropics, livestock, including sheep, perform both tangible and intangible roles. In Kenya, indigenous sheep can be classified as either fat-tailed or fat-rumped. The indigenous sheep in Kenya include the Red Maasai, East African fat-tailed and Somali Blackhead Persian. In this study, nine fat-tailed sheep populations from Kenya were characterized using 15 autosomal microsatellite markers. The data generated was used to estimate the genetic diversity, population structure and relationship. The nine sheep populations had a wide genetic base with mean number of alleles ranging from 6.27 to 7.60 and an expected heterozygosity of 64–70%. Assessment of the population differentiation showed moderate but significant values of $F_{ST} = 0.053$ ($P = 0.001$). AMOVA analysis showed a 5.3% genetic variation amongst populations and a 94.7% variation within populations. Individual specific analysis showed that 96% of individuals in the Olmagogo population were correctly assigned but only 59% of individuals in Homa Bay were correctly assigned. Genetic diversity was great within the sheep populations rather than between as supported by AMOVA tests. The populations displayed divergence when subjected to phylogenetic and principle component analysis. The exotic sheep clustered together in one group whilst the indigenous sheep clustered together in the other group. However, Kajiado population deviated from expectation by clustering together with the Dorpers' indicating that crossbreeding was rife in the region.

Genetic diversity and relationships of African sheep: A Y chromosome perspective

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Abstract: In livestock, evolutionary or population genetics studies at the male lineage are uncommon due to lack of informative markers on the Y chromosome. Recently, in sheep, two Y chromosome specific markers have been developed: a bi-allelic A/G single nucleotide polymorphism (SNP), and a multi-allelic microsatellite SRYM18 marker. These two markers were used to analyze the Y chromosome diversity and population structure of 447 thin-tailed and fat-tailed African and 44 non-African male sheep from 35 distinct breeds. A total of five microsatellite alleles (131 bp, 139 bp, 141 bp, 143 bp and 145 bp) were observed. At SRYM18, the highest diversity was found in two thin-tailed sheep breeds from West Africa, Djallonké from Senegal and Maure of Mali, each with three alleles (139 bp, 141 bp and 143 bp). The other breeds had at least two different alleles, with the exception of three fat-tailed sheep breeds, Gumuz, Sekota and Tukur, from Ethiopia that had only one allele of 143 bp. Continent-wide, the 143 bp allele was the most common, with a frequency of 72.9%, and it was distributed in all geographical regions. The 141 bp allele was observed in both the thin-tailed and fat-tailed sheep with continent-wide frequency of 19.7% while the 145 bp allele was only found in the fat-tailed sheep with low frequency (8.8%). The 131 bp and 139 bp alleles are rare on the continent with their respective continent-wide frequencies being less than 1%. SNP screening detected only the A allele. A combination of results from the SNP and the microsatellite marker confirmed the presence of three haplotypes: 141/A; 143/A AND 145/A with a respective frequency of 16.7, 72.5, 72.5 and 10.8% in the African breeds. Haplotype 143/A had the highest distribution in the East and Southern Africa regions with a frequency of 90.5 and 60.0%, respectively, while in West Africa haplotype 141/A was the commonest with a frequency of 87.%. These results are in agreement with archaeological information suggesting a distinct origin for the West African thin-tailed and the fat-tailed sheep from East and South Africa.

Improving the livelihoods of poor livestock-keepers in Africa through community-based management of indigenous farm animal genetic resources

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Abstract: Small ruminants provide very important genetic resources that can be exploited for continued improvements of the livelihoods of poor livestock keepers in the pastoral production system, particularly in the developing country situation, Kenya being one of them. Though important, the motivation of livestock keepers to hold and maintain particular AnGR in conditions of decreasing animal genetic resource base is imperfectly understood. Consequently, in an endeavour to improve the livelihoods of resource-poor small ruminant livestock keepers, it is important to understand the underlying drive that motivates livestock keepers to keep and maintain particular AnGR. This can be achieved if producer responses in production that lead to either loss or conservation of these resources are sufficiently known. This study contributes to the existing knowledge gap by analyzing the status of small ruminant breeds in the pastoral production system in Marsabit district of Kenya. Primary data, collected from livestock keepers using structured questionnaires, revealed that small ruminants contribute enormously towards livestock keepers' livelihoods, especially the poor, and subsequently, to conservation of the resource. The results obtained from multinomial logit models derived from stated choice data collected from 314 respondents in the semi-arid Marsabit district of Kenya reveal that disease resistance is the most highly valued trait whose resultant augmentation is a welfare improvement of up to KSh. 3082 and 1480 for goats and sheep, respectively. In goats, drought tolerance and milk traits were found to be implicitly valued for up to KSh. 2695 and 1163 respectively, while in sheep, drought tolerance and fat deposition traits were found to be implicitly valued at KSh. 973 and 748, respectively. The study further revealed that improvement in milk trait in does, body size and disease resistance traits in bucks, and drought tolerance trait in both does and bucks will collectively improve the producers' welfare and hence should be given priority. However, improvement in the reproduction and production ("overall body condition/ meatiness" trait) potential of goats

will be worthwhile only if issues concerning access to pasture and water resources are addressed early and simultaneously. The results further point out that for livestock stakeholders to effectively improve the livelihoods of poor livestock keepers, development strategies for improving the management and/or utilization of small ruminant genetic resources in terms of drought tolerance in sheep, should not only be tailor made to target regions that are frequently devastated by drought but should also precede other strategies or efforts that would first lead to the improvement of producers' economic status.

Genetics polymorphisms at candidate genes for diseases resistance in chicken: A comparison between indigenous, commercial and wild chicken

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Abstract: Viral diseases affecting chicken, like Marek's disease and avian influenza, are currently causing tremendous losses in the industry and greatly impacting the livelihoods of the small scale farmers in the least developed countries. There is no effective cure or vaccine to control these diseases. It is believed that domestication and commercialization of poultry may have led to the loss of genetic variability at innate immune genes with commercial populations more susceptible to disease compared to indigenous and wild populations. The main objective of this study was to identify and assess DNA polymorphisms present at innate immune candidate genes for genetic resistance to avian viral diseases. Two candidate genes were short listed from the literature: the BLB2 major gene has been associated with Marek's disease resistance and Mx gene is a putative candidate gene towards resistance to avian influenza. Species homologs of these two genes were obtained from Gene Bank and analyzed with the PAML package to detect possible signatures of selection over evolutionary time (dN/dS). PCR followed by sequencing was carried out on both genes with PCR optimization for Mx gene being successful. Seventeen populations comprising commercial, indigenous and wild populations were analyzed for allele, genotype and haplotype frequencies. HWE, diversity indices, and population divergence was analyzed to detect possible recent signatures of selection in different populations. Nine SNPs were discovered in a partial segment of the Mx gene amplified. The frequency of the A SNP allele at Mx position 299 of the amplified gene segment corresponding to codon 631 in the Mx protein that encodes resistance to avian influenza was the highest in the wild population. The distribution of the alleles at this locus was found to be due to drift and not selection for disease resistance towards avian influenza. Seven loci of the Mx gene segment had some population groups deviating significantly from HWE. Likewise haplotypes from the Indian and East African subcontinents deviated significantly from HWE. The East African subcontinent had the highest diversity

as well as the highest haplotypes. Haplotype 1 and 5 are the possible ancestral haplotypes. There was some geographic correlation found between haplotypes and avian influenza outbreaks. This result suggests that the haplotype would be more defining towards disease resistance as compared to a single SNP studied. Tests for signatures of selection on the Mx gene, using population differentiation tests show evidence of recent signals of positive selection (selective sweeps, genetic hitchhiking and population differentiation) in the wild populations. Signatures for selection tests based on species divergence for both the Mx and BLB2 genes show amino acid sites in the functional domains of the two proteins across all species under positive selection. In conclusion, both genes studied show evidence of adaptive evolution. Further work needs to be carried out on both candidate genes with more sequence information on a longer gene fragment, in a larger sample and population size in order to confirm these first results and pave way for more studies.

Herbivore hotspots in the Mara ecosystem in relation to land use change and climate change

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Abstract: Ecosystem characteristics determine the formation and persistence of hotspots of herbivore abundance and species diversity. Increasing pressure on land due to expanding human population and development increasingly restricts the distribution and mobility of herbivores in protected and pastoral ecosystems, reducing their flexibility to cope with frequent climatic extremes. This study examines, first, if different herbivore species and their functional groups occur in distinct hotspots, or if hotspots of different species overlap in space. Second, the study explores how these herbivore hotspots are influenced by spatial variation in seasonal and annual patterns of standing biomass of green forage and how climate and land use change modifies the location and prevalence of the hotspots.

I used a twenty year data set of wildlife counts collected by the Department of Resource Surveys and Remote Sensing of Kenya (DRSRS) in the Mara since 1977 to characterize the probability of occurrences of herbivore hotspots in 5x5 km² grid cells between 1977 and 2002. The probabilities of hotspots of abundance and species diversity were regressed against the corresponding probabilities of hotspots of vegetation greenness (NDVI) to understand how changes in vegetation influence the location of hotspots. The regression models included NDVI, region, Eastings and Northings and their various interactions with NDVI to account for the possibility that hotspots may vary with location due to different land use and management practices over and above the influence of NDVI. These results showed that different functional groups occur in spatially distinct hotspots with minimal overlap among different species. Different species were influenced by different factors and thus may require contrasting management strategies to sustain viable populations in the face of climate and land use changes. Furthermore, protection in conservation reserves alone is unlikely to guarantee the survival of all the species considered.

Key words: Hotspots, climate, landuse, NDVI, Mara-Serengeti

Human-elephant conflict in pastoral areas north of Maasai Mara National Reserve, Kenya

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Abstract: During the last two decades, human-elephant conflict has become the most challenging and pressing problem to African governments, wildlife managers and local communities. With eighty percent of the African elephant's range lying outside formally protected areas, conflict appears to be increasing in most elephants ranges as human activity intensifies. Mitigating direct conflict between human and elephant has hence become an urgent political and conservation issue. Human-elephant conflict in Kenya is perhaps the most noticeable threat to elephant conservation and increasingly threatens rural community livelihoods. Mitigating conflicts requires a detailed understanding of the conflict situation in a specific elephant range and the underlying patterns and processes; this information is seldom available. This study examined the types, spatio-temporal distribution pattern of human-elephant conflicts (HEC) in an area of 1707 km² within three group ranches adjacent to Maasai Mara National Reserve (MMNR), Narok District, Kenya. It investigated the extent to which the intensity and the distribution of HEC are influenced by land use types and human, livestock and elephant populations over the last three decades. Research methods include participatory methods, a questionnaire survey, conflict mapping and secondary data from DRSRS, CBS and KWS. Spatial data were analyzed using Geographical Information system (GIS) while appropriate statistical tests were conducted using SPSS, SYSTAT and SAS programs. Four main human-elephant conflicts were identified to be occurring in the study area; elephant attacks on human and livestock, crop raiding and elephant mortality from anthropogenic causes. All these conflicts were found to be intensifying in the study area. Between 1970 and 2004, a significant increase in human deaths and injuries caused by elephants ($F = 26.971$ $r^2 = 0.4903$, $p = 0.000$), livestock killed by elephants ($F = 17.764$ $r^2 = 0.6651$, $p = 0.006$) and elephant mortality ($F = 13.042$, $r^2 = 0.2015$, $p = 0.491$) was observed. The intensity of these conflicts appeared to peak between 1996 and 2002. 98% of the resident community said that crop damaged by elephant had

also increased within the same period and 69% could not cultivate their land due to elephant presence. During the 2004 growing season, 25 of the 38 farms that were cultivated were damaged by elephants. Spatially, human-elephant conflicts showed a clustered distribution with similar patterns observed for people attacks and elephant mortality, while livestock attacks occurred randomly. Intensifying conflicts in the group ranches are closely associated with cultivation, vegetation type, and spatial pattern of Maasai bomas and an increase use of the group ranches by elephants. Contrary to many studies that demonstrated an increase in conflict incidents closer to a protected area, this study showed that presence of a protected area was not strongly associated ($r^2 = 0.4395$) with an increase in human-elephant conflicts, supporting suggestions that HEC depends more on relative distributions and behavioural characteristics of both human and elephant populations involved than their relative abundance. Despite this increase in human-elephant conflict in the study area, local community members who received substantial revenues from tourism had a positive attitude and were more willing to coexist with elephants compared to the majority who did not receive any revenue. The survival of elephants in the ranches will depend on active efforts to reduce the conflicts associated with the presence of elephants in the ranches which currently has eroded the community tolerance to elephants.

Investigation of breed differences in immune responses to ECF immunization

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Abstract: *Theileria parva* is a tick-borne intracellular protozoan parasite that causes ECF disease in cattle and demonstrates obligate sequential differentiation stages in lymphocytes and erythrocytes. The immunity to the parasite infection is mediated by cytotoxic T lymphocytes (CTL) that target the parasitized lymphocytes and lyse them. It is reported in informal communications that local indigenous breeds of cattle in the Lake Victoria basin appear to be more resistant to ECF disease than exotics but what is not known is why some animals are resistance while others are susceptible. There are reports showing the Ankole longhorn and Tarime cattle breeds suffer a less severe disease and have lower mortality than European Taurine (*Bos taurus*) cattle breeds. Thus, this study used local and exotic breeds of cattle and compared the immune responses to ECF. This study specifically compared differences in cellular immune responses and clinical assessment between Ankole, Tarime which are *Bos indicus* and Taurine (*Bos Taurus*) cattle breeds following immunization against ECF using the infection and treatment method.

The findings in the study showed that the Tarime and Ankole breeds are tolerant while the Friesians are susceptible to ECF. The phenotypic analysis of the CD8+ T cell sub-populations of PBMCs in the three breeds post immunization and post challenge did not show any significant differences. In the majority of the animals (32 out of 34) in the study no cytotoxic T Lymphocyte (CTL) response detected in peripheral blood post immunization and post challenge. Cross reactive CTLs that recognized autologous cells infected with different *T. parva* strains was observed in all the breeds on recall and it was more marked in Ankole followed by Friesian and least in the Tarime. Marked lysis of target cells by CTL was observed for TpM followed by TpZs then TpU and least in TpL. In situations (post-challenge) where a mixture of TpM and TpL were used as stimulators, the cross reactivity trend was observed more in Ankole followed by Friesian and least in the Tarime.

The marked lysis of target was observed against TpM, TpL, TpZs and TpU in that order. This study provides a basis for further studies on biomarkers for the comparative resistance of Ankole and Tarime breeds to ECF infection compared to exotic breeds.

In vivo identification of trypanosome protein(s) interacting with the *Glossina* Midgut Proteolytic Lectin

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Abstract: Protein-protein interactions mediate in the transformation of parasites during the course of infection. The *Glossina proteolytic lectin* (Gpl) is associated with the transformation of the bloodstream trypomastigotes into the procyclic forms within the midgut of the tsetse. This allows the trypanosomes to adapt in their new invertebrate insect host because the trypanosomes encounter a hostile environment and infection is established when the trypanosomes are able to survive and differentiate. This study was undertaken to identify the trypanosome protein(s) that act as interacting partner(s) of the *Glossina proteolytic lectin* (Gpl) leading to the proliferation of the African trypanosomes.

This study was performed *in vivo* using the GAL4 Yeast-Two-Hybrid system. The complete Open Reading Frame of the proteolytic lectin gene from *Glossina fuscipes fuscipes* was used as bait to fish for gene(s) present in a cDNA-AD fusion expression library constructed *in vivo* from the bloodstream forms of *Trypanosoma brucei brucei*. False positive clones were eliminated by selection of clones transcribing three reporter genes i.e. ADE2, HIS3, LacZ genes and by segregation analysis. Recombinant plasmids from positive colonies were identified using differential blue/white color screening. Characterization of positive blue yeast colonies (ADE2+/HIS3+/LacZ+) by PCR using AD-insert screening amplimers yielded no results showing a re-organization of the vector during a positive protein-protein interaction. Restriction digestion with Nde I and BamH I dropped inserts of approximately 800 bps while the empty vectors were of different and unexpected sizes. The putative positive library clones were identified, sequenced and analyzed by bioinformatics. Nucleotide and deduced amino acid sequence analysis showed that the cDNA insert corresponded to a truncated Gpl gene. PCR and restriction digestion characterization of a white yeast colony (ADE2+/HIS3+/LacZ-) yielded a cDNA insert of approximately 800 bps. The empty vector from restriction digestion was of the correct size. The nucleotide sequence of the cDNA insert showed

a 97% identity with a hypothetical *Trypanosoma brucei*/AJ234097 gene and a partial identity (5%) with a serine-rich protein from *Shizosaccharomyces pombe* (PIR/T39903/T39903) when interrogated in the *Trypanosoma brucei* Gene Index (TGI) (PIR/T39903/T39903) from TIGR. In the NCBI database this gene corresponded to *Trypanosoma brucei* TREU 927 hypothetical protein (Tb09.211.4290) partial mRNA. Further characterization of Gpl will provide more insight into its functions and its role *in vivo* on trypanosome during differentiation of the bloodstream trypomastigotes into the procyclic forms.

Performance of coffee farmers' marketing cooperatives and members' satisfaction in Dale Woreda, Southern Ethiopia

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Abstract: People form cooperatives to do something better than they could do individually or through a non-cooperative form of business. Forming a cooperative will not automatically solve business problems faced by individual households. This is because cooperatives are subjected to the same economic forces, legal restrictions and international relations that other business face. Cooperative members' expectations about the types and quality services that should be offered and their criteria for performance of these services have a major impact on the level of satisfaction or dissatisfaction felt. Members' satisfaction on the benefits obtained by establishing cooperatives should be evaluated by the level of the deviation of service expectation from perceived service performance. Thus, cooperatives' performance should be continuously checked against the level of members' satisfaction.

This study therefore aims at assessing the performance of primary coffee marketing cooperatives and thereby to identify factors that impede members' satisfaction. To evaluate the performance of coffee marketing cooperatives in the study area, financial ratios were computed based on annual audit reports of the cooperatives. Here, efficiency ratios, income ratios and credit worthiness ratios were calculated as performance indicators. As a result, almost all the coffee marketing cooperatives in the study area were performing their business inefficiently.

Profit regression model was also employed to identify factors influencing the members' satisfaction taking the overall cooperative performance, the adequacy and context of services rendered by the cooperatives, and the major services as functions of socio-economic and institutional explanatory variables. The model analysis revealed that age, family size, terms of payment for red cherry were found to be satisfactorily significant at

significance level of 5, 5 and 5%, respectively to influence negatively except the terms of payment for dry cherry which was influenced positively, the satisfaction members' of the coffee marketing cooperatives in the study area, with reference to the overall performance of the cooperatives as dependent variable.

Potential of Sudanese exports of sheep and sheep meat to the Middle East

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Abstract: The thesis focuses on interlocking themes of Sudanese sheep industry production, livestock markets, traders' performance, foreign trade, standards, service delivery, organizational arrangements, policy debates and field level experiences along the market chain till the ultimate consumers.

The objective of the study was to describe the socio-economic characteristics along the market chain of sheep and goats in the Sudan and to shed light on health and market constraints at specific market point, or points along the chain from producers to consumers. The supply chain framework used to design the study was suggested by Jabbar and Majok (2004).

In order to characterize the chains and their health and market constraints limiting smallholder access to markets, the following sample units were studied:

- village level condition of livestock resources, service and marketing infrastructure.
- household flocks.
- livestock markets-primary, secondary and tertiary.
- traders and exporters at the markets
- veterinary services at local, district and federal levels serving producers.
- veterinary quarantines

The study covered sheep producers and markets in the three states Gedarif, Blue Nile and West kordofan, together with El salam terminal market in Omdurman. The criteria for selecting the three states are dominance of sheep, diversity of production system, market outlets, and prevalence of poverty, and dominant sheep breeds.

With regard to competition, Sudan's market share in live sheep exports to Saudi Arabia was low, 29% in spite of the potentials and advantage of being near the Gulf markets. The Sudanese sheep and sheep meat faces tough

competition in countries like Australia, New Zealand and Syria. Competition is in the form of price, reliability of supply and terms of trade in the case of Australia and New Zealand, and in the form of quality of product and other non-price factors in the case of Syria. The problem faced by Sudan is thus to enhance its competitiveness in the Middle East markets for sheep and sheep meat in order to increase and maintain its market share and in order to make use of the great potential it has.

The methodology depends on secondary data collection at the national and state levels as well as at the local authority and administration unit levels. Questionnaires were used to interview market participants (producers, market intermediaries, traders, exporters) in addition to personal interviews and group discussions. The data were coded and entered in the SPSS data management section of the computer program. Descriptive analyses were performed using the SPSS statistical software. Econometric views (E view) software was used to analyze price time series data for co-integration. Hence, provision of numerical values and parameters for economic relationships e.g. marginal values, regression analysis and co-integration.

The results indicated that lack of market infrastructure, inadequate legislations and regulations and the absence of institutions. Co-integration test was applied to test the relationship between supply markets and the terminal markets. It showed that there is co-integration between Omdurman and El Obbeid sheep markets as well as Omdurman and El Damazeen markets and between El Damazeen and El Obeid sheep markets. A high integrated market is likely to increase market efficiency through efficient resource allocation and price transmission, which is likely to lower transaction costs and increase incomes to actors.

Regression analysis results indicated that the traders' performance in terms of profit margin. The relationship between traders' margin in adult sheep and the independent variables (number of adult sheep sold and price per adult sheep sold) are progressively related: the increase in them will increase the traders' profit margin in the adult sheep while the relationship between the number of adult sheep purchased and price per adult sheep purchased is inversely related; the increase of price per adult sheep purchased will decrease the traders' profit margin in adult sheep and so is the increase in number of adult sheep purchased.

The implication from the analysis is that the Sudan Government's policy should focus on enabling legislation and infrastructural development. This entails improving the internal marketing system to enhance its efficiency, improving the quality of products by enforcing grades and standards, preparation of the product for the market and protecting the disease-free status. It is of paramount importance to establish a single administrative unit in the Sudan with legislations and full responsibility for livestock and meat marketing.

Policy and institutional analysis of smallholder cattle production in Dano District of Western Showa

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Abstract: Livestock play an important role and have major contributions of agricultural GDP in some sub-Saharan Africa countries in general and in Ethiopia in particular. Ethiopia has the largest livestock resource than any other African country. In Ethiopia, the livestock sector is very important for the farming community in general and in Dano district of Western Showa, Ethiopia, in particular. Much livestock production in the country relies on indigenous animal genetic resources. However, much hasn't been done in terms of their improvement so that these traditional practices are threatened by pressure of economic development. Besides, these unique resources are believed to be at risk of loss due to genetic erosion. The main objective of this study is to analyze the existing policy and institutional environment in order to identify policies that enhance improved and sustainable use of indigenous breeds/strains, and to identify immediate strategic options to address current constraints/threats. The study was conducted in Dano district of Western Showa. A total of 150 farmers had been interviewed in the study area in December 2006 and January 2007 to generate primary data for the study.

Policy Analysis Matrix (PAM), binary logistic model and descriptive statistics were employed. Furthermore, sensitivity analysis with various scenarios was undertaken to assess the effect of the different strategies on poor livestock keepers. The study result suggested that both private (financial) and social (economic) profits were positive; implying that indigenous cattle production in Dano district was profitable for producers as well as for the country at large. Moreover, eight explanatory variables were hypothesized to explain farmers' choice for market-oriented indigenous cattle production activities. These variables were significant to affect farmers' choice for market-oriented indigenous cattle production activities. In this study, possible policy implications were made in order to improve conservation, management and sustainable use of market-oriented indigenous animal genetic resources.

Production and marketing systems of sheep and goats in Alaba, Southern Ethiopia

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Abstract: This study has undertaken to describe the sheep and goat production and marketing systems and identify constraints to and improvement options for smallholder farms of Alaba, southern Ethiopia. Results are based on survey of 150 sample households and rapid appraisal of major sheep and goat markets. Flock distribution and holdings in different parts of the *woreda* vary and thus the study sites were stratified into mixed sheep–goat flock, goat dominating and sheep dominating sites. Average family size of the study area was 6.7. Literacy of household heads accounts for 30%. Across the sites, mean holdings of total land, grazing land, cattle, sheep, goat and equine numbers varied significantly ($P<0.05$) with the goat dominating site having higher values than the others. With respect to livestock holdings, above half of the total TLU was recorded in goat dominant site. The mean holding of 7.4 sheep ($P<0.05$) and 11.5 goats ($P<0.05$), respectively, are higher in sheep and goat dominating sites. Sheep and goats are primarily kept for sale to generate cash and majorities (98.9%) of goat owners extensively milk their flock for household consumption. Sucking young (22.8% lambs; 26.7% kids) and breeding female (39.3% ewes; 39.4% does) dominate the flock. Respondents reported that grazing on crop stubble (13.4%), private pastures (13.3%) and road sides (13.2%), weeds (11.6%), tillers and fillers (8.9%) from crop fields, cut-and-carry of browse species and grasses (9.1%) and communal pastures (9.4%) are major feedstuffs of sheep and goats. Flock water are largely comes from rivers (Bilate and Dijo) (55.2%), artificial ponds (21.9%), trough and harvested water. Diseases and parasites cause significant ($P<0.05$) losses of flocks (34.6%). Rate of loss is higher in young (35.0% lambs; 35.5% in kids) and mothers (42.9% in ewes; 30.6% in does). Losses by predators is noticeably higher ($P<0.05$) in goat dominating site. Body conformation, physical characteristics (coat color, horn and tail), known local ecotypes and age are the major criteria household considers in selecting sheep and goats for castration and fattening. Smallholder farmers make fattening management targeting the seasonal holiday markets. The major destination of fattened flocks is the Addis Ababa market while

young flocks go to the export abattoirs. Addis Ababa consumers demonstrated high preferences for animals from study areas and evidently pay higher prices. This is largely exploitable opportunity for development of smallholder sheep and goat production. Flock production is constrained by outbreaks of disease and parasite, predators, feed and water shortage, lack of production technology and seasonality of markets. Interventions covering flock health, feed production and managements, water development, marketing, credits to build flock holdings, and extension supports delivering the necessary training and production technologies/inputs could help farmers to build their flock and improve productivity.

Key Words: Sheep, goats, smallholder farmers, production systems, marketing systems, constraints, improvement options, Alaba, Southern Ethiopia.

Production system and marketing of goats in three agroecologies of former Dale District of Sidama Zone

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Abstract: Production system and marketing survey on 120 households was studied to identify and describe goat production system to determine production potentials, opportunities and challenges of goats' production and to describe marketing systems. The study area is stratified into three agro-ecologies. Sample households were interviewed on socio-economic characteristics, flock structure, reproductive performance of goats, feed resources and feeding, routine husbandry management systems and marketing using a pre-tested formal questionnaire. Flock monitoring to identify off-take and acquisitions like birth, purchase, transfer and disposal like sales, slaughter, death was carried out for about seven months (September 2006 to March 2007). Three primaries, one secondary and one terminal markets were studied at Dale, Tula and Hawassa respectively using Rapid Marketing Appraisal (RMA) data collection technique.

The average family size was 7.5 ± 0.247 per household, out of which 5.6% of the households were female heads and there were no significant difference ($P < 0.05$) in family size among the three agro ecologies under study. About 75% of interviewed male households and 50% female households were literate. The overall mean livestock of holdings is 13.1 ± 1.16 . The average livestock holdings in the moist Kola are significantly higher than the average holdings in the moist Weyina Dega and Dega. The overall mean of goat holdings per average holdings is 5.98 and there is a wider range of variations in flock size. The overall mean of AWA, AFM, AFK, AKI, was 5.2, 9.7, 14.9, and 8.6 months, respectively. The overall mean litter size is 1.62 and lifetime kidding age is 13.2 months. AWA in moist Dega was 6.47 ± 45 which is significantly longer ($P < 0.05$) than moist Weyina Dega and moist Kola. Similarly 16.13 months of AFK was shown in the moist Dega which is significantly higher ($P < 0.05$) than moist Kola but moist Weyina Dega is an intermediate of the agro-ecologies. AKI is 8.56, 7.27 and 8.57 months in moist Dega. Moist Weyina Dega and moist Kola respectively and the variations were significant ($P < 0.05$). The mean

LS for moist Kola (2.07) is significantly higher ($P<0.05$) than that of moist Dega and moist Weyina Dega. No significant variation was observed between moist Dega and moist Weyina Dega. Goats in moist Kola have shown long lifetime kidding 16.27 years which is significantly longer ($P<0.05$) than the other two agro-ecologies. Feed resources for goats varied among the three agro-ecologies. Major feed sources in moist Kola are shrubs and browsing trees, but feeds from crop by products, crop residues, eset and fruit trees, vegetables and chat left overs are the main feed resources for tethered and herded goats of moist Weyina Dega and Dega. Lack of feed, disease and marketing are the major constraints effecting goats' production. The increasing demand of goat meat, the experiences of flock holders to carry small scale fattening activities, fast growing goat meat butcheries and demand for goat market, the conduciveness of the environment and sufficient family labouring the three agro-ecologies are some of the opportunities to improve goats production.

Recombinant expression of potentially immunosuppressive proteins of the tick vector *Amblyoma variegatum*

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Abstract: Development of improved vaccines against tick infestations offers a cost-effective and environmentally sound control method. Although a limited number of protective antigens against tick infestations have been identified and characterized, discovery of novel antigens remains a limiting step for improving the efficacy of tick vaccines. Components of tick saliva/salivary glands, some of which are immunomodulatory proteins, are being considered as candidates for future vaccines. Experiments with a T-cell immunosuppressive protein of *Dermacentor andersoni*, coined p36, elucidated the functional role of one class of these proteins. The objective of the work reported in this thesis was to produce recombinant proteins from sequences identified in the *Amblyomma variegatum* gene index (AvGI) which have homology to the *D. andersoni* immunosuppressive protein p36. Basic local alignment search tool (BLAST) searches of the AvGI and other tick databases using the p36 sequence identified a total of nine homologues, including four from *A. variegatum*, with both sequence and length polymorphism. In addition, multiple sequence alignments of these sequences revealed there might be a large family of immunosuppressive proteins (ISPs), perhaps representing a spectrum of immunomodulatory activities. Two putative p36 homologues of *A. variegatum*, TC183 and TC350, were cloned, sequenced and expressed in recombinant forms. Sequence analysis of TC183 and TC350 predicted the presence of a signal peptide and potential glycosylation sites on both protein sequences. Recombinant proteins were expressed using *E. coli* and purified as insoluble inclusion bodies using immobilized metal affinity chromatography (IMAC). SDS-PAGE and western blot analyses shows that these tick proteins are stable when expressed and purified from *E. coli*, despite their insolubility. The function and usefulness of these insoluble proteins as protective antigens in cattle remains to be determined. However, the data and reagents described herein will facilitate further characterization of these proteins and evaluation as vaccine candidates.

Review methods of estimating parameters in known linear mixed – effective (nlme) models

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Abstract: This study is a critical review of theoretical issues that underline the linear mixed effects (LME) and nonlinear mixed effects (NLME) models. These two areas revisited under maximum likelihood and restricted maximum likelihood estimation frameworks. We also review methods of estimating parameters in both linear and nonlinear mixed effects models. In the case of LME, we consider different ways of developing the likelihood estimators, key among these methods are the “pseudo-data” approach, orthogonal triangular decomposition method and use of penalized least squares problem.

For NLME, we intended to investigate the computational efficiency and accuracy of computational methods, like the b-splines, that could be used to approximate the log-likelihood function in non-linear mixed effects models. This was not achieved in this study but can be an interesting area for further research work. We critically review the four methods of estimating parameters by Pinheiro and Bates (1995) through proving a number of lemmas. Our proofs led us to same stated results by different researchers in different papers. This is a key issue in the investigation of other expansion methods and comparing their computational efficiency and accuracy with these existing ones.

We conclude by giving an insight into linear mixed effects models by analyzing a data set from livestock where we examine incorporation of random effects to study variations among rams (sires) and ewes (dams) and their influences on lamb weaning weight. Factors like year of birth of the lamb, sex of lamb, age at weaning, age of dam, ewe breed and ram breeds. It was our intention to obtain heritability estimates which determine the proportion of the variation among offspring that have been handed down from parents out of these random estimates. Keywords: repeated-measures data, multilevel data, longitudinal data, LIME, NLME, “pseudo-data and b-splines.

Seasonal migration and rural livelihood: The case of Bahir Dar town and three rural kebeles in Amhara Region

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Abstract: Seasonal migration of labour to Bahir Dar town and other rural areas is found to be an important component of the livelihood strategies of people living in the study area. This study was aimed at examining the opportunities and challenges of seasonal migration of labour on the livelihoods of migrant people. To generate the necessary data, both qualitative and quantitative techniques were employed.

Seasonal out-migration of labour in the study area is undertaken by many rural households so as to diversify households' portfolios, save and invest in rural areas, and reduce risk and vulnerability. The remittances obtained from this type of migration have served rural households to supplement their income from agriculture and alleviate the problem of land shortage and landlessness. In addition to the remittances, labour migrants bring back home some kind of items such as household utensils, consumable goods, clothes and educational materials. They are positively contributing to the development of the recipient area by supplying cheap labour power. On the other hand, they exert pressure on social services in the town, increase unemployment, and pollute the environment. The major factors that drive rural people to migrate for seasonal wage earning employment are attributed to economic, social and cultural factors. The availability of employment opportunities at destination and the attractiveness of the payment appear to be another major pull factor of seasonal out-migration of labour. The stream of seasonal out-migration of labour is predominantly carried out to rural areas of other regions. Most of them have earlier experiences of out-migration either to the same place or in other areas and they prefer rural to urban areas for their future out-migration and permanent residence. Migrants usually stay at destination from 1–5 months and the majority migrate in September as this time is the peak labour demanding time at the destination. Because of their short stay at the destination, the skill acquired by migrants is negligible. The major problems in

which labour migrants often face during their journey and at the destination are inability to get social services, social discrimination, labour exploitation, exposure to illnesses, misleading information, shortage of transportation, and robbery.

By considering the positive contribution of off-farm seasonal wage employment towards improving the livelihoods of the rural poor, the rural development strategy should be directed towards promoting a policy that maximizes the benefits incurred from labour migration and minimizes the risks and challenges associated with it. There is also a need to consider labour migration as an alternative livelihood option for the poor rural households in increasing assets, reducing poverty and alleviating the problem of farmland and landlessness.

Sesame market chain analysis: The case of Metema Woreda, North Gondar Zone, Amhara Region

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Abstract: This thesis has analyzed the sesame marketing chain, particularly the case of Metema *woreda*, North Gondar Zone, Amhara Region. Sesame is a major cash crop which is mainly produced as an export crop. The most commonly grown crops in Metema *Woreda* include: sesame, cotton and sorghum. The total average cultivated land covered in 2005 by sesame, cotton and sorghum were 47, 23 and 26%, respectively.

This particular study revealed that 94% of the sesame production was supplied to the market. The major determinant factors for market supply were estimated by OLS regression. The sesame market performance was also measured using indicators of marketing margins and the level market integration. Critical periods for sesame purchase were identified and 78% of the total market supply was transacted during November, December and January 2006. Purchases sharply declined after January and not a single sale was observed during July, August and September.

Transport cost was identified as the major cost component of marketing costs which accounted for 31.52 and 60.20% of the total cost wholesalers and exporters, respectively. The integration analysis indicated that there existed market integration between Metema, Mekelle and Addis Ababa markets, showing relative market efficiency in these markets.

Spatial determinants of poverty in Uganda

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Abstract: This study sought to examine the spatial determinants of poverty in rural Uganda. It was undertaken based on the theoretically informed expectation that certain spatial characteristics of where an individual or household lives can be important determinants of whether those residents will attain an adequate level of welfare to meet their basic needs. With the aid of small area estimation techniques, and a special regression models, the study combined sub county poverty estimate from the 2002 high resolution poverty maps obtained from the most recent Population and Household Census (2002), and the National Household Survey data (2002/2003), with up-to-date spatial data (2000–2006) to analyze the impact of these characteristics on poverty in the country.

We found that the nature of heterogeneity necessitated the specification of different models for specific regions of the country. Results indicated that different spatial factors affect certain regions differently, thereby warranting regional specific policy interventions if poverty reduction is to be realized. The results indicate that various spatial characteristics of where communities live play a key role in determining whether those communities will attain a given level of welfare.

Vegetable market chain analysis in the Amhara National Regional State: The case of Fogera Woreda, South Gondar Zone

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Abstract: Vegetable as a group of crops from the horticulture category has a very wide importance both as a source of food and health care. On the contrary, the level of consumption is very low for reasons of unavailability and market imperfection. Even with limited pocket areas of production, the product suffered low price and lack of market. As a result, glut and spoilage are common. Measures to solve the problem were limited partly for reasons of little research and lack of attention. Hence, this study was initiated to partially fill the gap.

The overall objective of the study was to analyze vegetable market chain with a focus on onion and tomato. The specific objectives were to assess structure-conduct-performance of vegetable marketing, analyze market supply determinants, identify problems and opportunities in vegetable production and marketing. For the purpose of completeness demand analysis was also conducted.

Formal and informal data collection tools of both primary and secondary data were used. Econometric models like Heckman two stages (for market supply analysis) and double-log linear model (for consumption analysis) were the tools used for the analysis.

The cost-revenue calculation results indicated that on the average a farmer profited 8,191 ETB from shallot, 13,141 ETB from onion, and 5,111 ETB from tomato per hectare production (Assuming an average price of 1.75 ETB, 1.65 ETB and 0.75 ETB per kg prices in that order). However, this potential benefit is under challenges of imperfect marketing. The market conduct is characterized by unethical practices of cheating and information collusion that led to uncompetitive market behavior even though the calculated concentration ratio did not indicate oligoposony market behavior (26.15%).

With an estimated volume of annual production of 324,412Ql of onion and 40,402Ql of tomato, the estimated marketed proportion according to the respondents was (95% of onion and 86% of tomato). This showed that Fogera is entering to commercialization albeit the challenge in marketing. For success of the started race, measures to improve marketing like correcting the malpractices, implementation of defined standard and grades, provision of market information, networking with the central potential buyers like urban cooperatives or groups at Addis Ababa seem important. Capacity building for all actors in the chain and strong extension service on product handling and marketing to farmers should get focus.

Volume supplied to market were also analyzed and the same variables in the case of land allocation for onion also came up significant for onion supply but in the case of tomato it was experience and number of oxen owned by the respondent that came up with significant coefficients.

The average monthly level of consumption was assessed when the Fogera produce was at the market and was used to see some properties of consumers. Based on the 91 sampled consumers from Gondar, Bahir Dar and Woreta towns it had been revealed that the average monthly income per household was 1,372.21 ETB. Average family size was 5.7 where the monthly average consumption of tomato per household per month was obtained to be 5.11 kg of tomato and onion 7.34 kg onion. A household spent on the average about 44% (603.10ETB) of their monthly income on food from which 7.62% (45.96 ETB) was spent on vegetables.

For assessing accessibility, the average distance a certain consumer measured per single feet trip was taken and the average was estimated from the respondents to be 0.485 hours. More than 97% of respondents reflected a strong interest on quality. According to the survey data, on the average respondents expressed their willingness to add 0.046 ETB per kg for tomato and 0.05 ETB for a kg of onion.

Econometric analyses of demand revealed that from the proposed determinants it was income, purchase frequency, distance, own price and single purchase lot that were identified to be significant for both vegetables.

Women's access to and control over land in the current land administration system in two rural kebeles in Ada'a Woreda of Oromiya Region

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Abstract: The study is designed to explore the status of rural women in access to and control over land in the current land administration system in two rural Kebeles in East Shewa Zone Ada'a Woreda of Oromia region on smallholder farmers' landholding registration. The Oromia National Regional State Rural Land Administration and Use Proclamation and its implementation procedure are examined from a gender perspective in terms of ensuring rural women's landholding rights and control they have over land.

Historical overview on the land question in Ethiopia revealed that tenure systems evolved through historical periods. Land remained under men's control throughout history and men's control over land was strengthened by the rural land reform carried out by the Derg. This tenure reform applied rural land distribution using households as unit for rural land allocation and women were disadvantaged as most rural households were headed by men. The Oromia rural land proclamation is not discriminatory on basis of sex. However, policy gaps are evident in addressing women specific issues such as issues of FHHs and women under polygamous marriages. Gaps also exist between policy and implementation. Customary laws and practices have serious impacts on women's land rights at the level of implementation.

The research applied both quantitative and qualitative methods in view of feminist research methodology to properly address issues from a gender perspective. Survey of 318 households was conducted administering questionnaires in the quantitative method. The qualitative method applied was interviews with relevant *Woreda* office and Kebele LACs, focus group discussions with rural women, case stories and observation. Triangulation method is applied in data collection, data presentation and in analysis of findings.

Study findings reveal that women's access rights to land is less equal than legally provided. This study evidences gaps between policy and implementation. Customary laws and traditional practices generally have impacts on land access rights of single/unmarried, divorced, widowed women and on access rights of women in polygamous marriages. Women's control over land is not efficiently addressed by the regional rural land policy. This is a significant policy drawback as women's equal rights on land could not be achieved without gaining control over land. The land administration system in general and the land registration process in particular has not considered women's participation in community activities and decision making. Women are not represented in LACs and Sub-Committees in both Kebeles.

Study findings indicate absence of autonomous institution as gap in addressing women's issues in the land administration system. This study also revealed loose linkages between the rural land policy and other regional legislations like the regional family law which provides women's equal rights on land in marriage and on its abandonment.

This study forwards recommendation to address gender gaps identified to ensure women's equal access to and control over land in the study area. The Oromia rural land proclamation needs revision from a gender perspective to address women's specific issues and the land administration system should consider women's participation in the process, their contribution to the system as well as their equal benefits from policy outcomes.

Modeling/livelihoods

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Abstract: This study was carried out in Mbeere district of Eastern Kenya among the smallholder stall managed dairy cattle and was aimed at characterizing feeding practices and collection of primary data for modelling of performance. This entailed the determination of both dairy livestock species and feed systems, and actual and theoretical stall managed dairy cattle management practices for lactating dams. In addition, the factors that bring about differences between the actual and theoretical feeding practices were identified. Cross-sectional data was collected from a total of 33 respondents in Siakago and Evurore divisions (16 from each division) in a one-month field survey using IMPACT (structured) questionnaires. Data on the feeding and lactation management was collected using an individual animal data card in a longitudinal survey involving 12 farmers (6 from each division) for a period of 3 months (May to July 2007). Data was entered into computer and comparative statistics calculated using Excel. Records were based on the responses or entries from the respondent. This study showed that most of the farmers fed their animals using fixed feeding trough and movable watering trough. The feed resources ranged from planted and natural forages, crop residues to commercial and home made concentrates. The common dairy breeds were Ayrshire and Friesian. In the two divisions, the basal material for feeding dairy cattle was maize stover. However, methods of processing the stover prior to feeding varied, either fed whole in unprocessed form to chopping using either panga or chaff-cutter was common. The planted forages were mainly Rhodes grass whereas the natural forages consisted of bush grasses. Only two farmers had plots of planted fodder trees (mainly Calliandra and Leucaena spp.). During the dry period, young and mature banana stems and procured concentrates (wheat and rice bran and pollard) were used to sustain the animals. Prolonged droughts, diseases and parasites, lack of technical feeding knowledge and genetic composition of the animal were identified as factors contributing to the low production of the cattle. Breeds, productive and adaptive traits are important in the selection of dairy stock. This study provided a framework needed for the development of modelling of nutrition of

smallholder dairy cattle needed for most ASAL community-based production improvement programs for the smallholder dairy systems within the constraints of slowly changing value chain continuum concept.

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